AMAZONIA

WITHOUT MYTHS

COMMISSION ON DEVELOPMENT AND
ENVIRONMENT FOR AMAZONIA

AMAZONIA WITHOUT MYTHS

INTER-AMERICAN DEVELOPMENT BANK

UNITED NATIONS DEVELOPMENT PROGRAMME

AMAZON COOPERATION TREATY

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INTRODUCTION AND ACKNOWLEDGEMENTS

The Amazon Cooperation Treaty (TCA), through the initiative of its Secretariat Pro-Tempore, requested the support of the Inter-American Development Bank (IDB) and the United Nations Development Programme (UNDP) in the preparation of a document to set forth the policies and strategies of development of the Amazon region. This initiative has proven of special interest for both institutions. In addition to being an excellent regional application of the proposals that the Latin American and Caribbean Commission on Development and Environment presented in its report entitled "Our Own Agenda," also sponsored by the IDB and the UNDP, it would serve as a contribution to the United Nations Conference on Environment and Development, UNCED 1992. It was for this reason that the two institutions accepted the request and made available the intellectual and financial resources necessary to make it a reality.

The objectives outlined in the documents requested by the Amazon Cooperation Treaty are essentially as follows: (i) to raise the level of national and international political debate concerning development and environment in the Amazon; (ii) to compile up-to-the-minute information on the reality of the Amazon, thus providing a basis for consensual discussion and, as far as possible, one with regional roots; (iii) to provide the members of the Amazon Cooperation Treaty with a document that may contribute to the debates on tropical forests which are programmed within the context of the United Nations Conference on Environment and Development in 1992.

The report "Amazonia Without Myths" does not pretend to be exhaustive. Nor does it compile, or pretend to compile, all the available information about Amazonia, nor all that can or should be said about its future development. However, due to tight deadlines and to the numerous contributions and diverse interests and backgrounds and total need to reach consensus on a broad range of issues, it may contain some imperfections. They will doubtless be evident to the reader. Imperfections aside, however, the report represents the vast consensus and will to improve the conditions of peoples of Amazonia and, in essence, it is this thought which we wish to pass on to the reader.

Enrique V. Iglesias, President of the IDB, Fernando Zumbado, Regional Director for Latin America and the Caribbean of the UNDP, and Luis Carrera de la Torre, Secretary Pro-Tempore of the TCA, invited a distinguished group of political and scientific authorities of the eight countries comprising the Amazon region to establish a Commission on Development and Environment for Amazonia. The Commission is composed of the following persons:

Virgilio Barco, former President of Colombia
Julio Barbosa, President of the National Council of Rubber Tappers of Brazil
Rafael Caldera, former President of Venezuela
Gabriel García Márquez, Nobel Prize for Literature, Colombia
José Goldemberg, Minister of Education of Brazil
Ailton Krenak, President, Centre of Indigenous Rights, Brazil
Oswaldo Hurtado, former President of Ecuador
Lachmie Persad Frederick Ramdat Misier, former President of Suriname
Javier Pérez de Cuéllar, former Secretary General of the United Nations, Peru
José Sarney, former President of Brazil
Luis Adolfo Siles Salinas, former President of Bolivia
Shridath S. Ramphal, former Secretary General of the Commonwealth, Guyana

The Commission benefitted from the cooperation and advice of four distinguished individuals: Mr. Julio Londono Paredes, Ambassador of Colombia to the Organization of American States; Deputy Arnoldo Gabaldón of Venezuela, Professor Ignacy Sachs of France, and Dr. Thomas Lovejoy, Assistant Secretary of the Smithsonian Institution of the United States.

A technical group was also convened which participated in several meetings to edit and prepare the report. The technical group was advised in turn on matters relating to the Amazon by representatives of indigenous and forest peoples, and jungle peoples, public officials, scientists, academicians and social and natural scientists, including Carlo E. Arze and Mario Baudoin of Bolivia; José Marcio Camargo, Eneas Salati, Pedro Ramos de Souza, Jorge Terena, Ilse Walker, Alcir Neyra, Eduardo Morales and Ana Valeria of Brazil; Patricio von Hildebrand of Colombia; Luis Carrera de la Torre, Angel Zamarena, Manuel Navarro, Teodoro Bustamante and Nelson Zuquilanda of Ecuador; Ulric Oid Trotz of Guyana; Antonio Brack, Carlos Mora, Alberto Chirif and Roberto Espinoza of Peru, and Carlos Barrera, Alberto Lizarralde and María Helena Medina Puig of Venezuela. Other members of the advisory team included Alwyn Gentry of the United States and Roberto Samanez of TCA.

The Commission and the technical group received valuable contributions from Carmen Miranda of Bolivia; Herbert Schubart, Philip Fearnside, Ernesto Maues da Serra Freire, João Ferraz, Bernard Pirson and Maria de Lourdes Freitas of Brazil; Javier Santa Cruz, Constanza La Rotta and Jorge Hernández Camacho of Colombia; Miguel Puwainchir of Ecuador; Evaristo Nugkuag of Peru; Nelly Arévalo of Venezuela and Edward Backus and Silvio Olivieri of International Conservation and Gale Gómez of the Commission for the Creation of the Yanomami Park.

The Commission met in plenary session on three occasions, in August and November 1991 and in January 1992. Also participating in these sessions were Mr. Iglesias, Mr. Zumbado and Mr. Carrera de la Torre, as well as high-level officials of the institutions that they represent, especially Lucio G. Reca, Manager of the Project Analysis Department and President of the Environmental Committee of the IDB. In each instance, the Commission members provided guidelines for members of the advisory group and edited its work. The advisory group met as a whole on two occasions in 1991—in Caracas, Venezuela, in June, and in Quito, Ecuador, in October. In addition, group members conferred on other occasions. The Amazon Research Institute (INPA) of Brazil provided special support, preparing and reviewing much of the scientific content of the document. TCA personnel provided vital logistical support for the advisory group meeting in Quito.

Antonio Brack edited the first two versions of the report, assisted on the economic themes by José Marcio Camargo and Eustaquio Reis. Germán Andrade and Consuelo Vidal reviewed technical aspects of the report and Fred Strebeigh edited the English foreword and summary. The drafts of the document were translated by Samuel Dubois. The English translation was done by Henry W. Goethals and Bárbara Meza. The publication of the report was coordinated by the Publications Office of the IDB under the supervision of David Smith.

Marc J. Dourojeanni, Chief of the Environmental Protection Division of the IDB, supervised the technical preparation of the report. Coordinators of the project were Emma Torres, Chief, Division of the Regional Programme, Regional Bureau for Latin America and the Caribbean of the UNDP, and Claudia Martínez of the same division. These three officials also supervised the final editing of the document.

It gives us great pleasure to present this report of the Commission on Development and Environment for Amazonia, which reflects the thinking of some of the region's most outstanding personalities on the complex subject of the future of the Amazon Basin.

In view of the forthcoming United Nations Conference on Environment and Development, scheduled for Rio de Janeiro in June of this year, and the need to establish a regional consensus on Amazonian development, the Amazon Cooperation Treaty has asked the Inter-American Development Bank (IDB) and the United Nations Development Programme (UNDP) to prepare a document which might serve to shape the debate initially in each country and in the region as a whole and, later, at the conference itself. This is the result of the effort of the Commission members, supported by a group of experts on Amazonian themes representing all sectors of opinion.

This report is closely associated with "Our Own Agenda," prepared by the Latin American and Caribbean Commission on Development and Environment with the support of the IDB and the UNDP. To a degree, it represents a regional application of the concepts of that previous report.

We wish to express our thanks for the effort and dedication of the illustrious members of this Commission and of the experts who advised them. They have contributed to a noble cause and one for which there are few successful antecedents, to wit, to reconcile economic and social development with the conservation of the natural environment. They know, furthermore, that the peoples of the Amazon are determined to face the future with courage and faith—standing proud as the trees with which their destiny and that of mankind is so closely linked.

Fernando Zumbado
Regional Director for Latin America
and the Caribbean
of the United Nations Development
Programme

Enrique V. Iglesias
President
Inter-American
Development Bank

Luis Carrera de la Torre
Secretary Pro-Tempore
Amazon Cooperation Treaty

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FOREWORD

The oldest pottery of the western hemisphere, dating from 7,000 to 8,000 years ago, was found in the Amazon Basin near Santarem, Brazil. In just one hectare of this vast world laboratory can be found more different tree species than in all of North America—and on just one of these trees can be found as many species of ants as exist in all England. This majestic basin covers only seven percent of the earth's surface but comprises more than half of the world's biological heritage. Its rivers hold one fifth of all the fresh water of the planet, and by itself the Amazon River is the largest tributary to all the world's oceans. More than twenty million people live in this enclave of age-old myths and fantastic illusions which, over time, have become intermixed with reality. This, in the world's imagination, is the earth's ultimate paradise.

It is, however, a paradise on the verge of extinction. Its slow and silent agony poses one of the most dramatic threats to human survival. The common belief has been that the world would end in a Biblical cataclysm. But reality is more disturbing than that: the world began to die many years ago, at the hand and disgrace of environmental degradation.

The facts are harrowing. An estimated six living species disappear every hour as a result of the massive destruction of the tropical forests. Originally, many of the native tribes that inhabited the Amazon jungles, aware of the ruin that they could cause, moved their settlements every five years in an effort to reduce to a minimum the damage to their environment. The ancestral wisdom of these tribes is being forgotten and extinguished, however, by the predatory actions of interests foreign to the region, which year after year destroy five million hectares. Thus have many of the native dynamics of preservation and survival been defeated. Of the six to nine million Indians who once inhabited the Amazon, only some dispersed and scanty groups remain. In this century alone, ninety entire tribes have ceased to exist.

However, an analysis of the deterioration in the Amazon cannot ignore the false ethic of the industrialized countries, which limits the world's ecological disaster to the deterioration of the tropical forests. In reality, the most serious causes originate in these same countries: the contamination of the air and the waters with all types of waste, global warming, the ozone layer depletion, the threat of a nuclear holocaust. And the most unpunished of all: social injustice and chronic poverty, which inflict destruction and ruin the length and breadth of the continent and, in the final analysis, affect all marginal areas of the industrialized countries themselves. In this regard, the salvation of Amazonia must become not merely a heroic feat of its natural trustees but a crusade that all humankind no longer can defer.

This report, prepared by the Commission on Development and Environment for Amazonia at the initiative of the Amazon Cooperation Treaty and supported by the Inter-American Development Bank and the United Nations Development Programme, is based on the concept of an Amazonia that exists above and beyond the world of fantasy and myth: an Amazonia of flesh and blood, of human toil, of human history, of human faces and hopes, and future human beings. It is an analysis based not only on the experiences and technologies of today's world but also, and with greater emphasis, on the wisdom accumulated for centuries by Amazonia itself: standing Amazonia.

Our gratitude must first go to the eight Amazon countries for the perseverance and courage with which they have kept alive until today the providential nature and cultural wealth of the region. Unfortunately, these prodigious and solitary efforts are being overcome by reality.

One of the great lessons of history is that the achievement of liberty must be immediately converted into a common responsibility and a just demand for cooperation. Generally, political decisions have a deeper impact on international conscience than ecological emergencies and the interests of state stimulate thought more rapidly than the penury of nature. In the case of Amazonia, achieving balance between these joint forces is not only possible but also unpostponable, and this is the spirit in which the present report has been inspired.

Given the magnitude of the problem, the challenge, therefore, is to change the global outlook: an international vision grand enough to fulfill the basic objectives of true development and to foster, at the same time, the ongoing welfare of Amazonia without affecting its ecological balance or the sovereignty of its people.

The present report understands and explains this. Its purpose, therefore, is not a simple request for aid to save the region, but rather the urgent announcement of an inescapable commitment which the international community owes to itself as it faces its own destiny.

Commission on Development and Environment for Amazonia, with the special collaboration of Gabriel García Márquez

IN SUMMARY, SO THAT MYTHS BECOME REALITY ...

In the shadows of the immense forests that covered a large part of the earth, myths and fantasies were shaped which even today captivate mankind. In a world with increasing desertification, pollution of air and water, and the extinction of many forms of life, the Amazon is a nostalgic symbol of the earth as it was at the time of Creation. The Amazon is a symbol, too, of hope for millions who aspire to a better and more dignified life, those who without meaning to, create an increasing disparity between their own needs and the arcadian vision of others. The adventure of humanity on Earth—this small planet on which we are all prisoners and passengers—has not provided an edifying illustration of progress in harmony with the natural environment.

This report was inspired by the need to resolve the dissonance between the development of those who live in Amazonia and depend on it, and its preservation as a natural legacy. This report is born of the conviction that development and well-being can be firmly joined in forging a better future, one that is more stable and secure. The Amazon is the continental heart of South America. Its fate, at the dawn of the 21st century, weighs heavily on our region, and, perhaps, the world itself. It is the earnest hope of the members of the Commission, and the experts who advised it, that this report can help clarify the debate regarding the way forward to sustainable development in the Amazon. We aspire to do in the Amazon what has not been done elsewhere: human development that is socially just, economically viable, and ecologically sustainable, to ensure that the Amazon may stand with pride.

I. THE AMAZON—BORN IN MYTHS

The Amazon was born of myth. Its very name derives from the mythical women, the strongest and fiercest ever known. What these women offered the ancients, it seems, the Amazon offers to many moderns; a repository of misunderstandings and dreams, an object of half-truths and desires—in short, a land of myth.

Modern man's misunderstandings about the Amazon are themselves understandable, for the Amazon embodies myth-like superlatives: the largest and most productive river on earth, the greatest number of plants and animals, the most extensive humid tropical rain forest on the planet. The mythical facts that we learned may have helped engender the mythical falsehoods that we encounter as adults: the myth of the single Amazon, the myth of the empty Amazon, the myth of the wealthy Amazon, the myth of the poor and fragile Amazon, the myth of the Indian as an obstacle for Amazonian progress. The existence of these myths demands informed analysis.

It demands analysis because the lure of the myth is the lure of the simple. All myths about the Amazon may be falsely simple; some are simply false. Like many untruths, they have the potential to do great harm. Such myths must disappear and, with them, the soft substrate of misinformation that continually undermines the complex reality of the Amazon. In this report, we offer a vision of an Amazon that is more than ancient and modern superlatives. We offer an Amazon that is more than myths.

II. THE INHABITED AMAZON

The history of the Amazon has ancient roots. Long before the arrival of the Spanish and Portuguese, the Amazonian vastness—from the Andean foothills to the River's beginning—was inhabited by humans. Great cultures flourished there, notable for their advanced systems of agriculture and native art, as did numerous forest cultures which for centuries maintained a harmonious relationship with nature. European occupation created activities sharply distinct from those of the original people. Rather, the Europeans sought their "El Dorado" on the new frontiers of a land that despite native presence they called "virgin." This spirit prevailed for some time after independence, when agriculture and cattle ranging and forest exploitation began. The price for the Amazon was very high. The forests were replaced, more than a hundred million hectares, by agriculture and grassland which today are mostly abandoned. The forests were also degraded by logging and extraction of vegetable products. The wildlife was decimated and most rivers were polluted by human activities, especially mining. As a consequence, instead of development, the Amazon suffered a process of conquest, colonization and exploitation. The price was very high, and we recognize the onerous responsibility and heavy generational debt created by this situation.

Today the Amazon is home to no fewer than 20 million people, including people of the forest, native Amerindians, rubber tappers, people living on the border of the rivers, farmers and miners, and people dependent on hunting and extractive activities. The majority of its inhabitants, however, grew up not in Amazonia but in their nations' zones of deepest poverty—from which they have fled seeking a promising frontier. Poverty and human inequities, then, are fundamental forces attacking Amazonian preservation. A large proportion of the region's population lives in the cities of the Amazon, mostly in slums surrounding each city's core, like those of other cities throughout Latin America. Like their predecessors on the Amazonian "frontier," newcomers find neither empty space nor virgin territory.

III. THE STANDING AMAZON

Despite past and present abuses which add to the reduction of its forests and perhaps also the supply of environmental services, the Amazon is still standing. It covers 7 percent of the Earth's surface, its flora and fauna encompassing more than half of the world's biological wealth, including a variety of hundreds of thousands of wild essences, trees of all sizes, many of them still not even classified and many others unknown. The importance of its waters, which amount to 15 to 20 percent of all the unsalted water on the planet, is demonstrated by the fact that the Amazon River itself is responsible for 15.4 percent of all the unsalted waters that flow into the oceans. Those waters are channelled through a maze of tributaries, lakes, "igarapés," canals, rivers and creeks of all sizes and shapes, some following still undecided courses, meandering through forests.

A vast part of Amazonia is still standing today, due to its sheer size and to the challenge inherent in any attempt to settle in it. But we have to recognize that Amazonia stands today thanks to the Amazonian people and countries. Amazonia's own defenders stood against intrusion by foreign settlers and extraction by foreign exploiters. Such abuses as the Amazon River Timber Company's plan to exploit the Brazilian forests and the Hudson Institute's scheme to flood vast reaches of the Amazon Basin failed to overcome the energetic rejection by the people and the governments of Amazonia. Amazonia stands today, also, because the Amazonian countries have embarked on a number of actions for the people of the forest—in concert with preserving the forest itself. All Amazonian countries have made an unparalleled effort to create protected areas to preserve biodiversity and have set aside extensive areas for the exclusive use of the indigenous peoples to protect their rights and culture. As an example, the territories of the Yanomami and Kaiapo Indians are the size of Portugal and Switzerland combined. Colombia has established, for instance, half of its Amazon territory for Indian reserves. But these are only a few examples of a little-known series of actions in favor of the region's conservation. The nations of Amazonia, despite the severe economic and technological restrictions that they confront, have never failed in their commitment to preserve it.

IV. TO KEEP AMAZONIA STANDING

It is clear that Amazonia belongs to the eight Amazonian sovereign states. It is also evident the Amazon cannot be merely a global ecological treasure or a global climatic regulator. It is also a major development resource: its sustained well-being remains inseparable from the well-being of the peoples of the eight Amazonian nations to which it belongs. The Commission strongly believes that the principles of sustainable development should guide actions to keep Amazonia standing. The aim of developing Amazonia on a sustainable basis must be the welfare of its people and the satisfaction of their legitimate interests. The development of the Amazon must, of course, ensure the endurance of its natural cycles, its renewable natural resources, and its biological diversity. But such development must be more than ecologically sustainable. It must ensure, also, that human communities shall endure: it must be socially sustainable. Only such development, broadly sustained, can ensure that Amazonia will stand forever.

To reach our goals, we must seek to develop technologies adequate to maintain the fragile ecological equilibria of the region and simultaneously contribute to our countries' economic development. Ecological and economic zoning is a useful tool which should be expanded and promoted. The legal recognition of zoning and its close correlation with economic policies suited to the ecological reality of each zone are important elements for its success.

The forestry resources of the Amazon are considerable and, until now, have been underutilized and at the same time squandered. The careful use of forest management techniques to ensure a sustainable production of timber and non-timber products is considered one of the best alternatives for preserving the region's biodiversity while ensuring economic development. Amazonia may evolve to host national, state, municipal, private or state parks, as well as indigenous and extractivist reserves in which forestry management is exercised at different levels of intensity for the production of timber as well as fruits, nuts, rubber and resins. However, the real thrust of the effort to conserve biodiversity must be the establishment and especially the effective management of the national park systems and the protected areas. These areas can contribute directly to economic growth through the prudent development of ecotourism.

Although in general Amazonian soils severely limit agriculture, there are parts of the territory where soils are sufficiently fertile for agriculture, including portions where sustainable technologies have been designed to protect the region's ecology and to favor perennial cultivation and several types of agroforestry. Extensive cattle ranching is not recommended, but intensive ranching associated with agriculture and forestry has a definite potential. Agricultural policy in the Amazon, however, should give high priority to increased productivity through intensive land use, because much of the land that at great expense has been devoted to agriculture has never been cultivated and is either abandoned or degraded. The recovery of degraded land should be awarded high priority in regional development plans. This can be accomplished by reforestation or the management of secondary forests which could supply important new industries. This alternative, as well as being economically promising, would relieve pressure on the remaining natural forests.

The considerable mineral and fossil energy resources of the Amazon could be extracted in a more organized and less damaging manner, on a socially and ecologically sustainable basis, if followed by a mandatory environmental restoration. Amazonia's vast and irreducible hydroelectric potential could be developed with environmentally sound technologies. For such development to go forward safely, technological research and development must lead the way.

V. BIODIVERSITY: THE PATRIMONY WE STAND FOR

The rich biodiversity of the Amazon must be preserved adequately and the rights of the countries to its benefits must be protected. We must prevent the capture of that richness by those who, though possessing the scientific and technological capacity to commercially exploit it, have no intention of adequately compensating the countries from which that richness springs. The wealth of Amazonia risks becoming the wealth of major corporations. The need to recognize the genetic heritage of the Amazon as the patrimony of its region is central for Amazonia's preservation. It is also essential that through patents, royalties or other mechanisms the Amazon countries be adequately compensated for the products of biodiversity they currently provide and which are now under global trade and biodiversity negotiations.

There is a global responsibility to support our countries' efforts to conserve and develop Amazonia. Our countries are investing in national parks and other protected areas, in preserving and understanding the vast biodiversity of Amazonia, in saving the knowledge of Indian cultures, and in research for sustainable management of the forests. The legal and administrative systems of our countries are being improved to increase their efficiency. These and other actions demonstrate the willingness to conserve the biological diversity of Amazonia as a first and essential step for success. Nevertheless, the magnitude of the resources required for its implementation exceed the present capacity of the countries.

The Amazonia of the future will be neither a huge natural reserve for biodiversity nor, as some have predicted, a red desert. Rather, Amazonia provides the real opportunity to put into practice the concept of sustainable development.

VI. THE PEOPLE: THE HEART OF THE AMAZON

Amazonian people possess a distinctive characteristic—their commitment to sustain nature. Indians on the one hand and rubber tappers (or *seringueiros*) and riverbank people, on the other, have lived for millennia and centuries, respectively, in intimate association with nature. In so doing, they have developed ingenious strategies and appropriate technologies which provide extremely valuable lessons for the future.

For centuries, the indigenous people have rarely been considered—except as obstacles to development. Now, however, the knowledge, technologies and culture of indigenous communities are considered essential for developing Amazonia. Today, after a long and difficult struggle for survival, more than 400 ethnic groups endure in the Amazon, with a population of about one million people.

Indigenous people are committed to recover, preserve and strengthen their culture, languages and knowledge, as well as to gain legal rights regarding the territories they need. They demand to be recognized as citizens with equal rights. But they demand also to conserve their cultural identity. They want to preserve and be compensated for the contribution they make to technological knowledge. Learning from indigenous communities and involving them in the decision-making process is a key strategy for the development of the Amazon.

VII. THE AMAZON IS NOT AN ISLAND

We must understand that the Amazon is not an island. It is affected by decisions taken miles away. The demand for petroleum or minerals and tropical products such as coffee, cacao, tea, rubber, lumber and oils, as well as the pricing policies of such commodities, have direct repercussions on the Amazon, a fact not taken into consideration by those who demand even stricter conservation of the forest and biodiversity. To break the vicious circle of poverty, which is both the cause and effect of damage to the environment, requires that we end the human anxiety produced by economic protectionism, worsening trade conditions, the legacy of foreign debt and the lack of a commercial infrastructure for commodities produced in the forest. As is well known, economic policies which provide incentives or disincentives for mining or agriculture have a direct impact on the Amazon. Priority should be given to the improvement of existing highways or the use of old river navigation systems. Decisions as to the construction of new highways should be weighed carefully, as they can attract an unforeseen number of immigrants to areas which are incapable of absorbing new settlers without serious damage to the environment.

The Amazon is especially affected by the poverty that plagues regions such as the Andes or the Northeast of Brazil. Inadequate land distribution and management, land degradation, natural catastrophes and urban poverty push people towards the Amazon, the latter being closely linked to the lure of mining gold and other ores. Thus, one of the more efficient options to reduce deforestation is to invest in some of the poorest areas in Amazonian countries, those that force populations to migrate to the Amazon to seek a better future. This option is rarely considered in national or regional development planning or by those in the industrialized countries who champion sharp reductions in Amazon deforestation rates.

The Amazon is also affected directly and indirectly by demographic growth. Although much of the region is sparsely populated due to a lack of access, there are also areas where small farms and poverty are intimately associated in an imbalance between population and resources. In general terms, the Amazon carrying capacity is limited by its reduced soil fertility. It is as essential to establish national population policies for the Amazon as for the entire national territory. Only thus can the demand for investment in education, housing, health and job creation be balanced against the availability of resources, which are in extremely short supply in the region.

VIII. GLOBAL COOPERATION FOR AMAZONIA

The Amazon is a lofty cause that should lift humanity. It should invite the world to engage in more sensible, more sustainable development. The economics of waste and the mass production of pollution must change. The world has witnessed an aggression against nature, sometimes by excessive poverty and sometimes by excessive wealth. Remarkably, to reduce the devastation of the poor may prove easier than to restrain the depredations of the rich. The industrialized countries must rise to meet their grave responsibility for the ecological degradation that the world now confronts.

Peace and democracy have to be sustained in Amazonia as in the rest of the world. While we recognize with satisfaction the great progress achieved in the field of disarmament, we consider that nuclear risks are still the single most important threat to the survival of humankind. The reduction of military expenditures is a common goal, in which we do not deny our responsibility. We wish to see tangible evidence that the resources of war can now be put to other ends. Border zones should be areas of broader cooperation and not of tension. We have to consolidate our region as a peaceful region and we have to sustain our spreading democracy and increase the participation of people and their organizations.

Solidarity and cooperation should be central on the dawn of the Third Millennium. To keep Amazonia standing, a broad sense of cooperation must emerge among all sectors of society. This implies cooperation of the public sector with private business and with non-governmental organizations, cooperation of the Amazon countries with each other, in order to exchange information and reach a common vision, and cooperation of the Amazon nations with the rest of the world, to develop a scientific and technological base that permits sustainable management.

The countries of Amazonia are committed to assuming their responsibility to ensure development and the environmental well-being of the region. More than ever, they stand committed to invest their economic resources and their talent in this cause. But the countries have not yet overcome the grave economic crisis which has affected them over the last decade. As a result, they confront severe difficulties in facing a challenge of this magnitude. The economic crisis has not only diminished their capacity for investment; indebtedness has created a serious exodus of talent, aggravated in turn by the weakening of academic and scientific research institutions and public institutions, which has helped undermine the administrative capacity of central and regional governments.

It is utopian to assume, therefore, that the Amazon countries can face up to the challenge of sustainable development without substantial external cooperation. Global cooperation towards Amazonia should include first, the mobilization of financial resources to support environmental and development action in the region and second, a determination to support development and transfer environmentally sound technologies to sustain Amazonia.

The industrialized world, in turn, must accept its economic burden. That burden will presumably reflect an awareness of Amazonia's long-term contribution to the world's environment: that the Amazon forest is key for absorbing carbon, for example, which otherwise would dramatically increase the greenhouse gases in the atmosphere and perhaps accelerate global warming, or that the Amazon range is key for preservation of vital hydrological and biogeochemical cycles and, obviously, for preservation of one of the world's great repositories of biodiversity.

But the industrialized world's burden must also reflect its long-term depletion of the world's environment, especially its industrial contaminants and its consumption levels. The industrial countries must demonstrate a commitment to sharing burdens in a manner commensurate with their financial capacity to create environmentally sound development technologies.

IX. LEGISLATION AND INSTITUTIONS FOR AMAZONIA

However much preservation of the Amazon may concern the world community, it concerns most of all the Amazonian countries. The issue therefore must be debated by them, albeit with the support of foreign scientists and of enlightened international opinion, and on their own terms. The Amazon debate requires far-reaching reform through pertinent legislation and institutions bearing on the region. The decision-making process will require the joint use of decentralized and participatory measures. Municipalities provide an excellent option for the management of natural resources and the environment and should be fully utilized. It is further recommended that the municipalities review and approve environmental impact evaluations of investments planned for the region.

The legal and institutional process should not stop at the level of municipalities, provinces, or departments, or even at the country level; rather it should reach the level of Amazonia as a whole. It is for this reason that the Amazon Cooperation Treaty (TCA), subscribed in 1978 by the eight member countries of the Amazon, commits them to "carry out joint efforts and actions to promote a harmonic development of their respective Amazonian territories, so that these joint actions produce equitable and mutually beneficial results, as well as the preservation of the environment and the rational use and protection of the natural resources of these territories."

There is a continued need to strengthen and expand an effective system of national and regional institutions for Amazonia. The quest for regional integration has been strengthened by growing global interdependency. Changing economic and political realities underscore the belief that strong nationalism represents a threat not only to global stability but also to the technological advances that have created a largely interdependent world, due largely to the speed of modern transportation and communications.

The dissemination of information is decisive for sustained growth. To this end, the need to develop a research and technological infrastructure in these countries is essential. A system to train and develop national and regional researchers should be promoted and support for their work must be provided. Information generated and gathered by foreign researchers on the Amazon should be shared and repatriated for use within the region. Publications should be made available in languages spoken in the region. Our countries need accurate scientific and technological data in order to make the informed decisions on which the future of the Amazon will depend.

X. FINANCING SUSTAINABLE AMAZONIAN DEVELOPMENT

Preserving Amazonia will demand more than a moral commitment. The Commission calls upon national governments, international agencies, bilateral and multilateral, to increase their commitment and action in support of a sustainable development strategy for Amazonia. National and international financing will be needed. Financial mechanisms that favor the Amazon should be developed and should be promoted. Effective compensation for services provided at full market value that take into account opportunity costs for Amazonian countries should be made. Grant resources and highly concessional financing should be mobilized for Amazonia. Initiatives which recognize the importance of the Amazon, such as the pilot project for Brazil of the Group of Seven (G-7) Initiative, are being promoted. These mechanisms are still insufficient and should take into account the social and biological complexity of Amazonia and their links with national societies. The Global Environment Facility, while recognizing the need for biodiversity and the need for regional strategies for the conservation of common ecosystems, is still limited in its outlook. All of these initiatives and financial mechanisms, and those being developed, should take into account the additional costs that conservation of the environment signifies for the Amazonian countries. These mechanisms should be broadened to include the complexity of Amazonia and also confront the harsh reality of poverty. Financial measures such as the establishment of a $1 fee for each barrel of oil consumed, for example, will contribute to the conservation and the sustainable development of the Amazon.

XI. IN SUMMARY ...

This call for global solidarity and cooperation to keep Amazonia standing demands no less than a new global ethic, an ethic that will produce an improved style of development, based on human solidarity and justice, and establish lasting peace. This can be achieved through an open and sincere dialogue, a dialogue that mobilizes commitment from each and every citizen of the Amazon countries and the world. This is not an easy task, but the approach of the dawn of a new century provides a unique opportunity. It is our hope that this report may help in this dialogue and in so doing transform Amazonia into a region where the best aspirations and hopes of mankind can be fulfilled.

I

DESTROYING MYTHS

From the arrival of the conquistadors, the Amazon has been the object of a mythological interpretation nurtured by ignorance and fear, half-truths, and generalizations or false extrapolations. Too often, these myths have been the motivating force behind the use and development of the Amazon. Their negative influence on thought and action, particularly political action, remains with us today.

One of these myths was that of El Dorado, now almost totally discredited, which deserves no mention in this document. However, other myths endure, among them: (i) the homogeneity of the Amazon; (ii) the myth of the empty or virginal Amazon; (iii) the myth of the riches or, by the same token, the poverty of the Amazon; (iv) the myth that the Amazon is "the lung of the earth"; (v) the myth of the indigenous peoples as "an obstacle to development"; (vi) the myth of the Amazon as a panacea for national problems and, finally, (vii) the myth of the "internationalization of the Amazon."

To focus objectively on the problems and alternatives for sustainable development of the Amazon, it is essential to keep in sight the true possibilities offered by the situation, as well as the severe limitations implicit therein. Thus, we must explain, interpret and, where necessary, destroy myths.

1.1 The Myth of Homogeneity

Too frequently the Amazon is believed to be only a green carpet traversed by long, winding rivers. No vision of the Amazon is more lacking in realism. The Amazon contains an indescribable natural, political and social diversity. It can be stated categorically that within the Amazon basin there exist many Amazons or many geographic and ecological facets of the same. The vision of the gigantic forest, dense and humid, where the explorer must battle heat, rain, Indinas, mosquitos and piranhas has been translated into a "green inferno." The notion of the Amazon as uniform and homogenous can be considered the mother of all myths.

The great heterogeneity of climates, of geological formations and of altitudes comprises a diversity of landscapes, matched by an equal heterogeneity of soils, of vegetable formations and of biodiversity. This provides the most palpable evidence that the Amazon is not homogeneous.

The political, social and economic heterogeneity of the region is also patent. Eight countries exercise jurisdiction here—Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela, as well as the territory of French Guiana. Each has its own style of government and its own politics and laws for the region, which do not always take sufficient note of existing bilateral and regional agreements. Each part of the Amazon differs as to development and potential, depending upon the availability of natural resources and the economic strategies adopted by the respective countries. The region is inhabited by a wide variety of human groups: indigenous peoples living in total isolation or in semi-isolation; residents of large and small cities and shantytowns; woodland societies engaged in logging and mining, and migrants of diverse origin.

The change of focus from homogeneity to heterogeneity is essential if one is to establish adequate strategies for each Amazonian area and reality. In the past the heterogeneity of ecological factors has influenced the origin of cultures, settlements and native technologies. In more recent times and following the dismal failure of many costly development programs, the countries of the region and international financial institutions have begun to take interest in territorial laws based on the diversity of resources and environmental conditions. An impression widely shared in the northern hemisphere is that Brazil is synonymous with Amazonia and that Amazonia is in Brazil, or that only Brazil is responsible for the destruction of the Amazon forests. This is, once again, a half-truth and has no bearing on reality. There are several reasons for this: (i) the largest segment of the Amazon basin and of the tropical Amazonian forests is located in Brazil; (ii) the actual Amazon River begins, in Brazil, at Manaus, and thus for the other countries of the Peruvian watershed as well; and (iii) the superficial knowledge of the Amazon that exists in the developed countries and in the Amazon countries themselves.

It is a fact that Brazil has jurisdiction over 67.79 percent of the Amazon basin while the other countries have only 32.21 percent, and that 58.50 percent of

Brazil's territory is Amazonian. However, several countries of the basin have an appreciable percentage of their own, and the percentage of their national territory as a part of the basin is of extreme importance: Peru alone possesses 13.02 percent of the basin; however, 74.44 percent of its national territory is located inside the basin; Bolivia possesses 11.20 percent of the basin, which comprises 75 percent of its national territory; Ecuador possesses 1.67 percent of the basin, in turn representing 45 percent of its territory. For Colombia, the proportions are 5.52 percent and 36 percent, respectively, while for Venezuela they are 0.72 percent and 5.78 percent, and for Guyana 0.08 percent and 2.73 percent, respectively.

Ecuador and Peru have the highest population density. They also put their Amazon territories to the greatest use, as reflected in the timbering operations in their respective zones. As to logging and other destructive activities, exploitation of the high elevations and the eastern slopes of the Andes Mountains by the Andean countries has a profound influence through the destruction of biodiversity, soil erosion, sedimentation, the contamination of rivers and lakes and the squandering of hydroenergy reserves. This influence is as pronounced or greater than in Brazil. This reality has received meager attention and overall responsibilities for the basin have not even been weighed. Brazil, simply, has been charged with responsibility for the Amazon and has borne the entire blame for negative environmental repercussions in the region.

1.2 The Myth of the Empty Amazon

The Amazon is commonly referred to as one "of the last frontiers of humanity" and as an "immense open space" that must be colonized. Some go to the extreme of referring to it as a "virgin" region. Such ideas are common in extraregional countries, particularly those in the northern hemisphere, as well as throughout the region itself. The former focus their concern on conservation of the Amazon as a nature reserve for humanity as a whole, forgetting that people live there and that they must grow and prosper. On the other hand, some of the nations which exercise jurisdiction over the area have considered it, and continue to consider it, as a natural resource to be developed, as a means of extending their agricultural frontiers and of relieving population pressures in peripheral areas. These nations, too, ignore the fact that there are peoples living there and that these people have rights.

The Amazon is neither an empty nor a virginal region where nature exists in a pristine and undisturbed state. Nor does it constitute an immense laboratory where the forces of nature act without human intervention. In truth, the region has a long history of human occupation, dating back more than 20,000 years; although little researched, this is a distinct reality. The region was subject to internal migrations in the pre-Colombian period as native tribes moved successively through the area, occupying, and later abandoning, large expanses of territory. The size of this indigenous population is difficult to calculate, but it is believed to have been approximately one million persons, excluding the peripheral, and especially the Andean, areas.

Following the European conquest, the region was slowly explored and occupied (1500-1840). Then followed by a period of forestry development (1840-1945), especially of rubber. The modern period, from 1946 to the present, has been marked by intense colonization and exploitation. An estimated 300,000 persons migrated to the Brazilian Amazon during the years of the rubber "boom." (Salati et al., 1990). Today the population totals roughly 20 million inhabitants, with several cities, among them Belém and Manaus, of more than a million inhabitants each. The Amazon population has an extremely high annual growth rate, exceeding 3 percent a year in some countries.

The region has also been widely explored for its mineral resources (petroleum, gas and ores) and is currently a battleground between conservationist and developmental interests on the one hand and native tribes, gold prospectors, miners, migrants and other groups on the other. The segment of the population dedicated to mining is increasingly important. The importance of groups such as the *garimpeiros*, despite their disordered life style, should not be overlooked. The exploration and extraction of hydrocarbons constitute important sources of employment and foreign exchange. Likewise, the communications infrastructure in the Amazon cannot be underestimated, comprising as it does some 42,000 kilometers of highways, river networks and airports (Table 1).

On the other hand, the Amazon is a region replete with economic potential, based on the raw materials that it can supply. In this sense, development is essential to its conservation, and in this biodiversity and cultural diversity must play important roles (Weigel, 1990). Nonetheless, it is recognized that the low demographic density of the interior of the Amazon contrasts sharply with the population of the region's large cities.

1.3 The Myths of Wealth and Poverty

The exuberance of its tropical vegetation has created the belief that the Amazonian soil is rich. Simultaneously, lack of knowledge as to the living and productive habits of the indigenous peoples has created a notion of the tropical wetlands as a kind of earthly paradise where the environment effortlessly provides all of life's basic needs. Even today, some politicians and the mass media continue to reflect this myth of Amazonian wealth, claiming that the "abundant lands" of the Amazon constitute an "emporium of riches" whose exploitation "would fill the larder" of their countries.

The myth of wealth was a major factor in colonizing the Amazon, leading to the discovery of the Amazon River as man searched for El Dorado and the spice islands. It was also a factor in the later rubber cultivation era. In the present century, it stimulated major development projects and the construction of highways favored and promoted by the countries. Furthermore, the myth was shared by international organizations, which financed such projects.

The truth is different, however. After four centuries of gradual foreign occupation and five decades of large projects based on imported models of development, the wealth of the Amazon has not lived up to expectations and millions of hectares of abandoned land provide ample proof of this fact. Billions of dollars have been invested in colonizing the Amazon; approximately 800,000 square kilometers of forest land have been cleared for farming and grazing; a massive movement of settlers and miners to the region has been encouraged. Results have been dismal and many of the projects have simply failed.

In any event, the experience has produced a squandering of resources which seriously compromises the future of a large part of the region. This provides the most palpable evidence that the wealth, especially of the soils, is only apparent, or that the true potential of the region has yet to be discerned.

The myth of Amazonian wealth has also distracted the countries of the region from resolving problems of population, justice and poverty. Instead of being resolved where they occurred, these problems have been exported to the Amazon. The Andean countries in general have preferred to send poorer elements of their populations to the Amazon rather than developing the *altiplano* and instituting social reform. The case of Brazil is similar as regards the population of the northeast and the south.

While cattle production has shown sparse results, despite official support and the use of subsidies, the bulk of the protein consumed in the region is still obtained by harvesting the natural products of the ecosystems, particularly fish and the flesh of wild animals—with the exception of metropolitan areas, which generally import their food from outside the region.

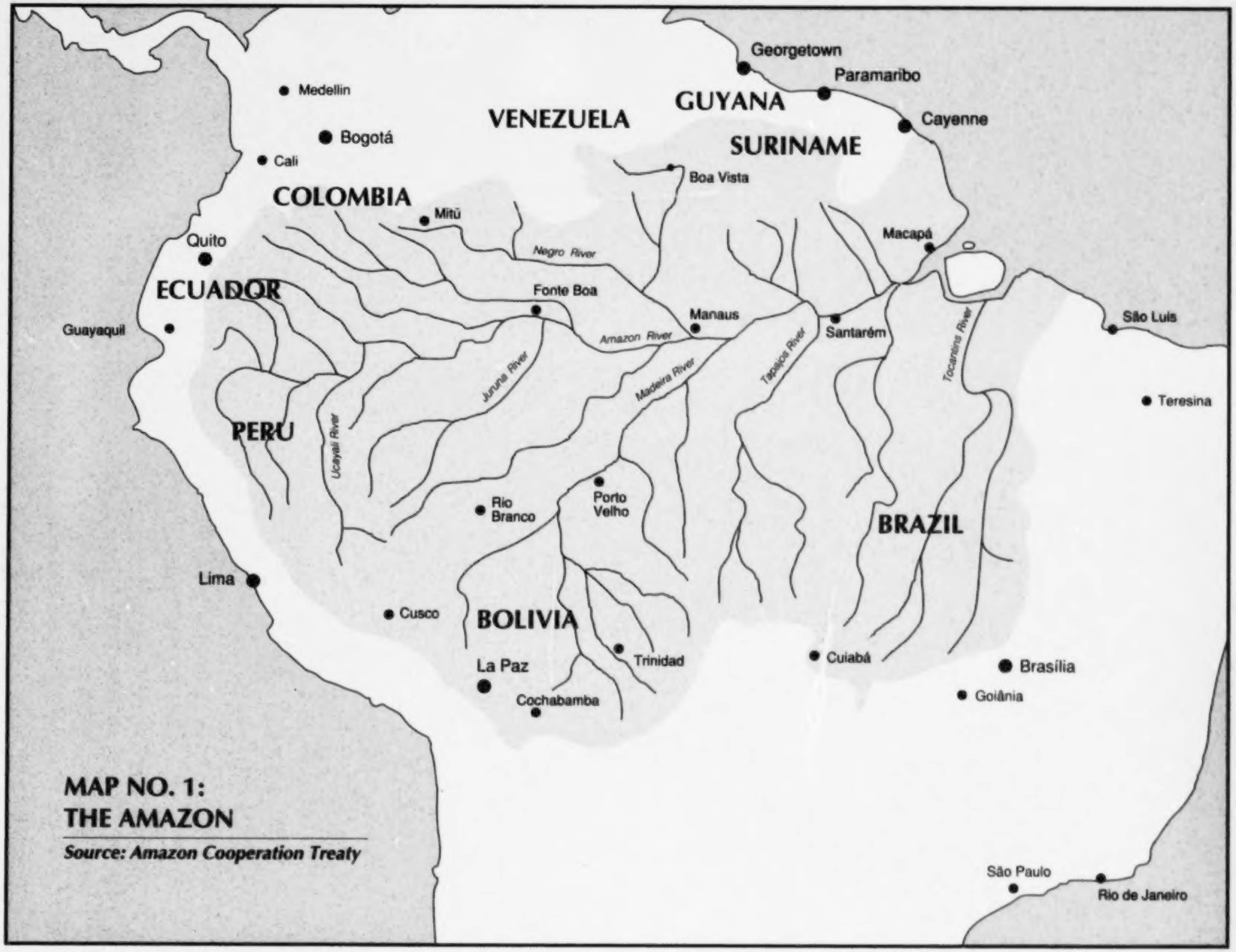
A high percentage—up to 80 percent in some instances—of the Amazon land currently used for farming and grazing has been abandoned. In most of the countries of the region, lands which rapidly lost their fertility have been abandoned as settlers moved to new lands in search of fresh or fertile soil to cultivate. In Brazil, the amount of degraded or unproductive pasture land is estimated at more than five million hectares (Serrao, 1990). In the case of Peru and Bolivia, failed livestock and legal crop ventures were replaced in some areas by the cultivation of coca to

TABLE 1: THE SETTLED AMAZON

Country	Highways kms.	Navigable Rivers kms.	Airports	Railroads kms.	Pipelines kms.
BOLIVIA	6,045	4,175	4	—	—
BRAZIL	17,299	27,182	41	1,385	—
COLOMBIA	3,077	6,020	15	—	24.0
ECUADOR	2,350	1,300	6	—	662.2
PERU	13,000	10,000	24	1,271	—
VENEZUELA[1]	254	1,619	5	—	—
TOTAL	42,025	50,296	95	2,656	686.2

SOURCE: TCA-Special Transportation Commission.

[1] Refers to the TFA and not to the Venezuelan part of the basin.


Medellin
Bogotá
Cali
VENEZUELA
GUYANA
Georgetown
Paramaribo
Cayenne
SURINAME
Boa Vista
COLOMBIA
Mitú
Quito
ECUADOR
Guayaquil
Negro River
Macapá
Fonte Boa
Manaus
Amazon River
Santarém
São Luis
Juruna River
Madeira River
Tapajos River
Tocantins River
Teresina
PERU
Ucayali River
Porto Velho
Rio Branco
BRAZIL
Lima
Cusco
BOLIVIA
La Paz
Trinidad
Cochabamba
Cuiabá
Brasília
Goiânia
São Paulo
Rio de Janeiro

**MAP NO. 1:
THE AMAZON**

Source: Amazon Cooperation Treaty

produce cocaine. Thus, settlements have spawned a succession of internal migrations in search of new land. It should also be noted that some settlers have returned to their places of origin or have migrated to cities in the region, creating problems of urban growth, poverty and marginality which are difficult to control. Part of the development and use of the Amazon is based upon its enormous forestry wealth Because of their extreme diversity, however, the Amazonian forests are more difficult to exploit in a sustainable manner than equivalent forests in Asia and Africa which possess a higher quotient of commercial-grade woods.

The myth of Amazonian wealth and the failures and unsatisfactory results arising therefrom have produced grave misconceptions as to the region's true economic potencial. This has created a severe impediment to an understanding of the region's real possibilities and has delayed the use of important developmental tools, among them biodiversity and hydrobiological resources.

Only recently has it been recognized that the wealth of the region is in the biodiversity of its ecosystems, its flora, its fauna and native germ plasm. What the indigenous peoples have known for centuries is now being "discovered" due to the need to seek alternatives for the future.

As a reaction to the myth of Amazon wealth, the myth of "Amazon poverty"—which is to say that the region is worthless and that development is impossible—has circulated in some quarters. This belief is advanced by many protectionists when reacting to proponents development. While the latter paint a picture of an Amazonian paradise overflowing with abundance, the former paint an exaggerated picture of regional poverty, each side engaging in half-truths to defend its position.

The Amazon offers true possibilities for sustainable development. It contains a variety of untapped or little-used resources, among them minerals, hydroenergy, biodiversity and even soils. More recent explorations show that the region contains important nonrenewable natural resources such as petroleum, gas, gold, uranium and iron, among others. Some countries, including Ecuador, Peru and recently Colombia and Brazil, have discovered important oil and gas deposits, and part of their economies is based on the exploitation of such resources. In the case of Brazil, reserves of bauxite, copper and iron have been discovered, corresponding to 88 percent, 75 percent and 35 percent, respectively, of the country's total reserves (Reis and Margulis, 1990).

The basin, and especially the eastern slopes of the Andes, possess considerable hydroenergy potential, still virtually untapped. This will play an increasingly important role in future development of the basin nations as an alternative to large dams at lower altitudes and in the generation of clean energy. Some 78 percent (=286.8 TWh) of Peru's hydroenergy potential, for example, is located on the eastern slopes of the Andes while 45 percent (=900.5 TWh) of Brazil's potential is similarly located (Dourojeanni, 1982).

There is much discussion about the poverty of Amazonian soils. The big question is whether they are rich or poor, what they are capable of producing, and how. Such discussions are generally limited to exogenous development strategies and to the dependent economic development models employed by the countries of the region. While a consensus exists as to the poor quality of the nutrients in much of the soil, technologies containing a high quotient of inputs exist that can make them productive. Although estimates differ, approximately one third of Amazon soils are considered suitable for agriculture, if and when adequate inputs and technologies are applied. The matter is largely academic, however, since to date the appropriate technologies are too costly and often unaccessible.

The other aspect to bear in mind is the highly relative character of various soil classification procedures. Everything depends, basically, on how each soil type is to be used. Soil classifications in widest use today are based on a foreign concept which considers the suitability of the soil for agriculture, livestock or forestry. Other forms of production are not considered. Even the worst soils can pay important dividends by producing forestry byproducts such as plants, fibers, foods, dyes and wild fauna, or through the use of integral Amazonian systems of polyculture, to wit, cacao, achiote, fruits, palm, etc.

Another area of considerable importance to the region is its hydrobiological resources. The Amazon is largely covered by rivers, lakes, lagoons and swamps, as well as jungle subject to flooding (*várzeas*) containing many useful varieties of mammals, birds, reptiles, fish and invertebrates. The native inhabitants as well as the non-native inhabitants, once adapted to the region, derive much of their protein from fish, which is an important part of the family, local and regional economy. Development programs have not paid sufficient attention to hydrobiological resources, which are considered marginal and even unimportant. In Colombia, despite the lack of precise records of catches in the basin, it is possible to estimate annual fish production at approximately 5,650 metric tons, equivalent to 16 percent of national production (Castro, 1991). Throughout the basin the annual fish yield exceeds 170,000 metric tons and, according to specialists, only 10 percent of the region's potential is being used (TCA-FAO, 1991)—although some species or individual regions show signs of overfishing.

Here again the foreign-technology phenomenon is a factor: great emphasis has been placed on the development of fish-breeding using imported species such as the tilapia, instead of investigating and taking advantage of native species (FAO, 1990).

The myth of poverty reveals once more the failure to adopt development strategies based on an Amazonian vision, coupled with the predominance of a foreign focus based on half-truths.

1.4 The Myth of the "Lungs of the Earth"

Those persons who seek forceful and even apocalyptic arguments to "defend" the Amazon spread alarming reports about what would happen in the event of large-scale destruction of the Amazon forests, charging that it would destroy one of the "lungs of the earth." In some quarters the argument is still heard that the Amazon region produces 80 percent of the world's oxygen. This is probably false.

When it is alleged that the Amazon produces a high percentage of the oxygen of the planet, the size and importance of the oceans in this regard is overlooked, and the importance of one tropical region over all other tropical regions is exaggerated. Also overlooked is the fact that a mature forest maintains an almost perfect balance between oxygen production and the fixation of CO_2. During the day, the forest fixes through photosynthesis 2.8 kilograms of carbon/hectare/hour, while a similar quantity would be consumed by the respiration of the biota of soil (1.8 kilograms/hectare/hour) and the respiration of the trees, estimated at approximately 1.0 kilograms of carbon/hectare/hour (Wofsy et al., 1988). Others calculate that about 36×10^{-3} gigatons of organic carbon are transported yearly by the Amazon River (Richey, et al., 1990). This datum, standardized for the total basin area (640 million hectares), would indicate an exportation of approximately 0.15 kilograms of carbon/hectare/day. Assuming that the Amazon is a climax ecosystem and the loss through the river is not due to a natural diminution of the stock of carbon in the system and/or anthropic action, this figure would represent the maximum potential liquid fixation of carbon by photosynthesis for the basin. Assuming that the Amazon is a drain of 36×10^{-3} GT of carbon and that for each 12 g of carbon fixated by photosynthesis 32 g of oxygen are produced, the total production of oxygen in the basin would be approximately 96×10^{-3} GT, representing only 8×10^{-6} percent of the mass of oxygen in the atmosphere. It is improbable, therefore, that the Amazon, in equilibrium, is the "lungs of the earth" or a significant drain of CO_2 (Victoria et al. 1990). On the other hand, mature forests trap a large quantity of carbon, which is released in the form of CO_2 when burned. This presents a real problem as burning of the Amazon forest sends significant quantities of CO_2 into the atmosphere, contributing to the greenhouse effect and global warming. Scientists today calculate that the burning of one hectare of Amazon forest would emit into the atmosphere between 147 and 199 tons of CO_2 (Klinge and Rodriguez, 1974; Fearnside et al., 1990). The CO_2 is the most important gas for its greenhouse effect, although other gases such as water vapor (H_2O), methane (CH_4), nitric oxide (N_2O), the ozone of the troposphere (O_3) and chloroflourocarbons (CFC-11 and CFC-12) are also important. Anthropogenetic emissions of CO_2 to the atmosphere are estimated at between 7 and 8 GT per year. The combustion of fossil fuels is the most important part. Deforestation is considered responsible for approximately one-third of total emissions (Houghton, 1991).

According to some sources (Goldemberg, 1989), Brazil was responsible for approximately 5 percent of global emissions of CO_2 in the decade of the 1980s, ranking as the fourth largest source of such emissions.

On the other hand, the contribution of the Amazon to the hydric balance of the planet is undeniable. The fresh water carried by the river to the sea totals 176,000 cubic meters per second and represents approximately one sixth of the fresh water flowing into the seas from all the rivers of the world. The contribution of the Amazon to its own hydric balance is also important in that the river receives 12×10^{12} cubic meters/year of rain, discharges 5.5×10^{12} cubic meters/year into the ocean and returns 6.5×10^{12} cubic meters/year to the atmosphere through evaporation (Salati et al., 1990).

1.5 The Myth of the Indigenous Peoples as an Obstacle to Development

The lack of knowledge at both the national and international levels about the indigenous peoples of the Amazon region has created two negative concepts—the first referring to the native as an obstacle to development, and the second, which adheres in almost exclusive fashion to the value of the indigenous model of development.

Especially in the countries of the basin, the indigenous peoples have been, and still are, considered an obstacle to the development, conquest and colonization of the Amazon. The reason relates to the lands that these peoples have occupied for centuries, to the manner in which they use their resources, and to their culture. In recent decades the basin countries have approved legislation guaranteeing, if only partially, the right of the indigenous peoples to their lands. Recognition of their ancestral territories and of the use of natural resources for self-support has also been partially achieved. The concept that the indigenous peoples have "too much land" and "don't produce for the development of the country" continues to prevail among settlers and those favoring development. Still not clarified, conceptually or legally, is the right of the indigenous people to the land and to more extensive territories in order to guarantee their culture, organization and freedom to live according to their own ancestral customs.

For more than four centuries, during the colonial period and thereafter, the basin countries have pursued one single-minded objective: to force the indigenous peoples to become civilized and adopt Western culture and religion as a condition for citizenship and the right to decide their own future. For these reasons, the indigenous peoples for centuries were subjected to territorial and cultural aggression which has created severe problems for them. The missionaries, the *conquistadores*, the rubber planters, the settlers and the *garimpeiros* have pressured, and continue to pressure the natives in an effort to convert them to the Christian religion, to civilize them, to enslave them, or to seize their lands and their resources. Many indigenous groups have disappeared and others suffer severe economic and social problems.

With the advance of anthropological research and systems for the management of natural resources in the Amazon, Western civilization has discovered the "indigenous model." This model, adapted over thousands of years to the heterogeneous and complex ecological system of the Amazon, has many interesting aspects to contribute to sustainable development. The indigenous peoples know the environment and the resources of the forest and the waters; they have developed technologies appropriate for their crops; they have domesticated plants and animals, and they know the properties of thousands of wild plants. In a word, they are fully capable of contributing to the improvement of regional systems of production.

There exists an abundant literature on the cultural, technological and organizational aspects of the indigenous peoples which allows for the introduction of many of these concepts into models of sustainable development for the region. One of the more important contributions is their manner of living in the forest, and of the forest, making full use of available resources in an integral and sustainable fashion for the support of its inhabitants. Many foreign migrant groups have adopted indigenous skills and have successfully integrated them into their own systems.

This objective reality, sustained by serious scientific studies, has led persons and institutions, especially from the northern hemisphere, to again exaggerate the efficacy of the indigenous model and to propose it as the only valid model while rejecting all external contributions. In this regard, it must be noted that indigenous models are valid under certain conditions and that they have helped to improve models imported from abroad. The manner in which the indigenous models use natural resources is based on isolation and certain social functions. With the adoption of alien cultural models, the indigenous model begins to lose its effectiveness, with the result that the indigenous people may begin to destroy the environment in much the same manner as any other human group. Such is the case of indigenous groups which have entered the market economy and find the need, justified or not, to sell products to foreign markets or to engage in livestock, agricultural or forestry activities as a function of that market. In these circumstances, the social organization dissolves and new attitudes develop.

Numerous researchers have studied the natives' models of production, their knowledge of the environment and their agricultural practices, comparing them with scientific Western models. Their conclusions coincide in noting that social organization and the social aspects of production are as important as the environment and the crops. These studies have altered the theory that the failure of the transfer of new technologies was due to ignorance and indolence (Hecht, 1991).

It is not possible today to accept the absolute validity of the indigenous model, except in the case of isolated indigenous peoples, and these are very few. Rather, we must study and discover how these models can foster sustainable development and adapt ancestral technologies of recognized value. A totally indigenous vision of Amazonian development is not only impractical but is just one more myth. We can no more adhere today to the concept of the ignorant native than we can dismiss his knowledge, culture, technologies and social organization. To the contrary, it is evident that the solution to the problem lies in an even and objective balance between both thrusts: to adopt what is useful from the indigenous model and recognize that sustainable Amazonian development has much to learn from these models.

1.6 The Amazon as the Solution to Peripheral Problems

In the present century, especially since 1945, the Amazon has been subjected to intense colonization pressures designed to expand the agricultural frontier and to stimulate economic activity in border areas by colonizing the so-called "hinterland." This has always been carried out with the direct or indirect support of state programs of the basin countries. Such colonization has been most intense in Brazil, Peru, Ecuador, Bolivia and Colombia and extremely limited or nonexistent in Suriname, Guyana and Venezuela.

The Andean nations are experiencing extremely serious social and economic problems in their high altitude, or *altiplano,* regions. Brazil is experiencing similar problems, principally in the northeast, which is semiarid and impoverished, and in the south where a lack of a jobs, inadequate agrarian reform and the progressive modernization of agriculture, among other factors, have forced the migration of rural workers. To help resolve these problems, large-scale colonization programs were initiated in the Amazon territories of these countries, stimulated in turn by the myths of the uninhabited Amazon and the fertility of its soils. Colonization has been complemented by road programs, the relocation of inhabitants of economically depressed peripheral areas and the construction of urban infrastructure and electric services.

The balance sheet on almost 50 years of colonization is negative. The problems of the peripheral areas have not been resolved while new problems have been created in the Amazon region. In effect, the situation in the Andean regions and the northeast and south of Brazil remains unchanged, or may have worsened. In the Amazon, poverty has increased and the quality of life declined and the future is more deeply compromised as a result of the previously mentioned massive squandering of natural resources.

1.7 The Myth of the Internationalization of the Amazon

Since independence, the Amazon countries should have assumed the defense of the Amazon against the forces of economic aggression originating abroad. During the decade of the 1960s there was frequent talk of the Amazon as an eventual refuge in case of nuclear war. In fact, military organizations in some foreign countries financed scientific research in the region. The Amazon countries should have spoken out vigorously against initiatives such as that of the Hudson Institute, which proposed the creation of huge artificial lakes in the basin—a plan which would have had a negative ecological and social impact of incalculable dimensions on the region.

When the myth of the Amazon as the "lungs of the earth" was invented in the 1970s, there were those, especially in the Amazon countries themselves, who thought that this could provide a further pretext for an assault on the region, and it was then that the myth of the "internationalization of the Amazon" made its appearance. In truth, the idea that the Amazon could be internationalized had never been suggested by any nation. The idea itself is absurd since the Amazon, regardless of its importance, is not the only region of considerable ecological importance to the world. Many other regions or biomasses are of equal importance. Take the case of the extensive temperate forests of northern Europe, Asia and America, for example, which fixate as much, or more, carbon than all the tropical wetlands and which are also threatened by development. The role of the seas, especially the territorial seas, and the oceans in the conservation of hydrobiological resources and in the preservation of an equilibrium in large cycles of nature is also recognized. And, speaking of biodiversity, it should be recalled that other parts of the world, particularly the tropical zones of Africa, are as rich as the Amazon. One such area is the Chocó region which covers the Pacific coast of Ecuador, Colombia and Panama. The argument for internationalizing each part of the world that may have global ecological importance is, therefore, simply absurd, and its use reflects either ignorance or ill will.

II

NOT ONE, BUT MANY AMAZONS

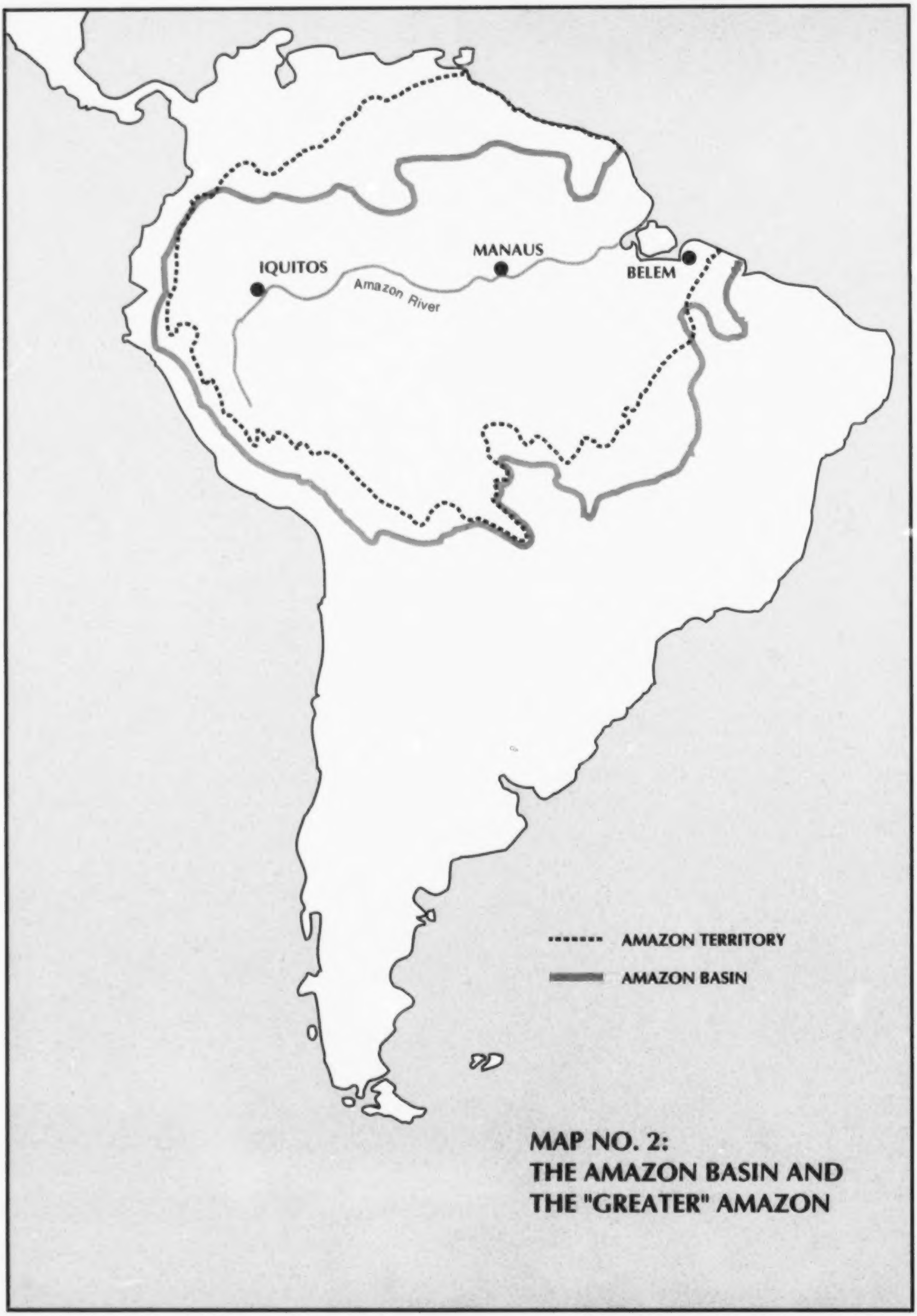
It is not easy to define the Amazon as there exist many foci or criteria for doing so, all of them valid. If the basis of the definition is not well understood, serious differences arise. For example, one can read widely varying data about the size of the Amazon, since it is one thing to talk about the Amazon basin and another, very different thing to talk about the "greater" Amazon, which extends outside of the basin, most particularly in the Orinoco region and into the Guyanas. On the other hand, the concept of the basin is subject to multiple interpretations. The most orthodox includes the snow-covered peaks of the Andes and numerous inter-Andean valleys which differ sharply in appearance from the universal vision of the Amazon. It also includes the area of the Brazilian mountains extending to the vicinity of Brasilia. Frequently, when the Amazon is discussed, an arbitrary altitude is established for the region. The altitude is often fixed as the tree line on the slopes of the Andes, which is between 3,000 and 4,000 meters above sea level, depending on latitude. Others consider that the Amazon begins much lower, at 300 to 600 meters above sea level. There are also political definitions of the Amazon, depending on the country; such is the case of the so-called Legal Amazon in Brazil. In each case, statistical information—as for deforestation—varies dramatically. The first thing that a person should do when he reads about the region, therefore, is to familiarize himself with the criteria of the author.

On the other hand, the Amazon, as already noted, is by no means a homogeneous unit. It contains great ecological heterogeniety, with different geological, geomorphological and climatic characteristics, as well as an immense variety of flora, fauna and soils. Despite these variations, which are especially marked on the slopes of the Andes, a predominant part of the region

TABLE 2: AMAZON WATERSHED BY REGION AND COUNTRY

Country	Watershed in km^2	% of National Territory	% of Watershed	Population
COUNTRIES OF THE HYDROGRAPHIC WATERSHED				
BOLIVIA	824,000	75.00	11.20	344,000
BRAZIL	4,982,000	58.50	67.79	17,000,000
COLOMBIA	406,000	36.00	5.52	450,000
ECUADOR	123,000	45.00	1.67	410,000
GUYANA	5,870	2.73	0.08	798,000
PERU	956,751	74.44	13.02	2,400,000
VENEZUELA	53,000	5.78	0.72	9,000
SUBTOTAL	7,350,621	—	100.00	21,411,000
COUNTRIES IN THE "GREATER" AMAZON				
SURINAME	142,800	100.00	—	352,000
FRENCH GUIANA	91,000	100.00	—	90,000
SUBTOTAL	233,800			442,000
TOTAL	7,584,421	—	—	21,853,000

SOURCE:TCA-Documents of meetings of the special commissions.


IQUITOS
MANAUS
BELEM
Amazon River
AMAZON TERRITORY
AMAZON BASIN

MAP NO. 2:
THE AMAZON BASIN AND
THE "GREATER" AMAZON

is recognized for its hot and humid climate. Beside natural diversity, there exists great, and at times little-understood social, economic and political heterogeneity. This so-called "Amazonian democracy" extends throughout the territories of the countries, which are considerably different from one another.

2.1 The Amazon as a Basin

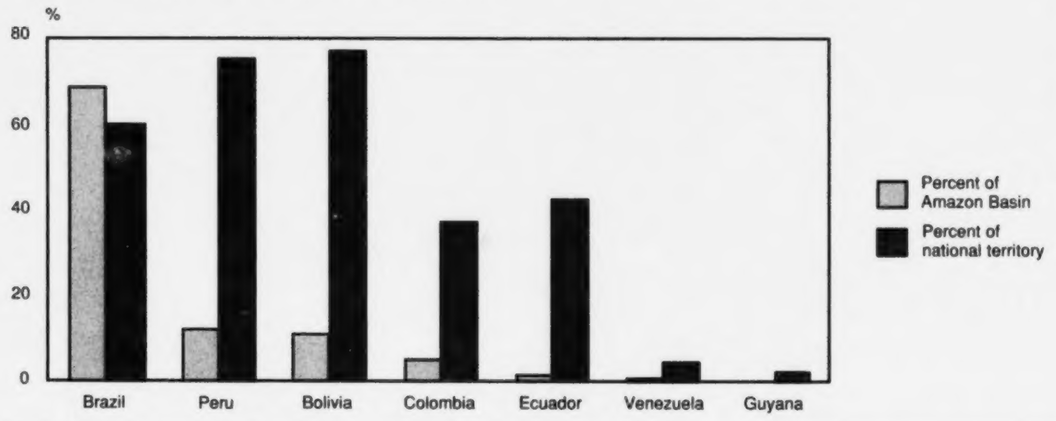
The geographic extension of the basin per se has not been accurately defined. There are great discrepancies in calculations as to size, although the most widely-accepted figure is 6,400,000 square kilometers. Nevertheless, if the sum of the parts of the basin corresponding to each of the countries is considered, the size of the basin exceeds 7 million square kilometers (Table 2, Figure 1). Combining one factor with another, therefore, this is the most widely-accepted version and also the one used in this document. The immensity of the area involved leaves little doubt that this is the largest basin in the world.

The main Amazon River system, the Amazonas-Solimões-Ucayali axis, is 6,762 kilometers in length, longer than the Nile River system (6,671 kilometers) which for some time was considered the longest river in the world. Approximately one thousand main tributaries drain into the Amazon from the massive mountains of the Andean chain as well as from the mountains of Guyana and the high plain of Brazil. These rivers constitute a complex system of water drainage and circulation produced by global and local weather patterns. In addition, the watershed's hydric network at the macro level consists of two main directional displacements: one longitudinal (north-south and south-north) in the case of most of the large rivers, and the other latitudinal, in the case of the Solimões-Amazon River whose displacement is west to east.

The Amazon is the most powerful river in the world. In Obidos (Brazil) its minimum average flow equals 100,000 cubic meters per second and its maximum average flow equals 220,000 cubic meters. The river's final discharge into the Atlantic Ocean has been estimated at 200,000 to 220,000 cubic meters per second (Richey at al., 1989). This means that the average annual discharge into the Atlantic is between 6.3 and 6.9 x 10^{12} cubic meters. The variations in water level during the year are considerable, ranging from 6 to 10 meters at the mouth and from 10 to 15 meters at midcourse. More important than the water level fluctuations at the mouth are the tides, including a tidal phenomenon called *pororoca* which is felt 600 kilometers inland. Because its waters flow dozens of kilometers out into the Atlantic Ocean, the Amazon has also been labelled a "sea of fresh water." The discharge of the Amazon represents 15.47 percent of all the fresh water discharged into the oceans by the world's rivers (Table 3) and the sediment that it deposits in the ocean is estimated at 10^9 tons a year (Salati et al., 1990).

The difference in the level of the watershed is extremely pronounced in the peripheral mountain spurs (frequently from more than 5,000 down to 600 meters above sea level in little more than one hundred kilometers) and extremely meager at lower levels. Along the river's more than 4,000-kilometer course

Figure 1
Amazonian areas in TCA member countries



across the plain, the fluctuation in water level does not exceed 200 meters, registering a change of only 107 meters between Iquitos (Peru) and the estuary (Brazil), a distance of 2,375 kilometers. This is why the large quantity of sediment carried by the river is deposited along its length, causing constant changes in its course. The great plain is dissected by numerous tributaries which have eroded deep channels in its soil and have created a complicated microstructure of hills, depressions and plains, at times with gradients of more than 45 degrees of barometric pressure.

2.2 The Physical Heterogeneity of the Amazon

The greater part of the Amazon region is a plain less than 200 meters above sea level extending 3,400 kilometers from east to west and 2,000 kilometers from north to south. This plain can be subdivided into low-lying, swampy areas subject to flooding and formed by holocenic sediment some 6,000 years ago; pleistocene terraces formed during interglacial periods, and the Amazon plain formed by clayish sediment with elevations of between 150 and 200 meters. This great plain is bordered on the north by the Guyana *altiplano,* made up of pre-cambrian rocks, ranging in height from 600 to 700 meters, and containing the highest peak in Brazil (Pico da Neblina or Sierra Koima, 3,014 meters above sea level); on the south by the Brazilian *altiplano,* also made up of pre-cambrian rocks and averaging 700 meters in altitude, and to the west by the Andes, of tertiary origin, dividing the watershed of the Atlantic and of the Pacific and with altitudes reaching from 4,000 to 6,000 meters above sea level. The Andes, from their creation, have been the principal source of sediment for the Amazon plain, currently supplying about 13.5 metric tons per second (Salati et al., 1990).

TABLE 3: DISCHARGES OF THE WORLD'S LARGEST RIVERS

River	Discharge (Average in m^3/sec.)	%
AMAZON	176,000	14.97
ZAIRE	40,000	3.40
ORINOCO	36,000	3.06
MISSISSIPPI	17,000	1.44
OTHER RIVERS	907,000	77.13
TOTAL	1,176,000	100.00

SOURCE: Salati et al., 1990.

The Amazon rivers have different physio-chemical and biological characteristics. Three types of rivers have been identified in the watershed: white, black, and clear or crystalline (Sioli, 1984).

The white-water rivers rise in the Andes and carry a large amount of sediment. The Amazon near Manaus contains 0.1 g of sediment per liter, relatively high quantities of dissolved salts and a pH between 6.5 and 7.0. These waters, which are the richest in nutrients, are also richest in hydrobiological elements. The black-water rivers contain little sediment, are acidic (pH below 4) and are low in electrolites, their dark color caused by the presence of humic and fulvic acids produced by the incomplete decomposition of organic matter. These rivers rise in the archaic mountains and in zones with tertiary sediment. During periods of flooding, river water covers the surrounding forests, creating a habitat known as *igapó.* The clear-water rivers are generally transparent and greenish; they carry little sediment and can vary widely in their physio-chemical characteristics, with pH between 4 and 7, due to the geological substrata.

The Amazon lakes, totaling in the tens of thousands and known by a variety of local names, were formed for the most part by arms of the rivers which were later cut off. The physio-chemical composition of their waters, varies widely and is generally related to the rivers which supply them (Forsberg et al., 1988). This hydric heterogeneity has an important influence on the vegetation and fauna, especially the aquatic varieties (Junk and Furch, 1985), on the river bank ecosystems (Salo et al., 1986) and on the associated fauna (Remsen and Parker, 1983).

Climatic heterogeneity is not manifested in the rains in the low sections of the watershed but is very pronounced in the peripheral zones, particularly on the slopes of the mountain chains, in temperature and humidity. The amount of solar energy which reaches the high atmosphere of the Amazon region is virtually constant throughout the year and the energy which reaches the surface varies according to cloud cover. In Manaus (Brazil), for example, the contribution of solar energy varies from 885 calories/square centimeter/day in January to a minimum of 767 calories/square centimeter/day in June, with an exposure to radiation approximately 50 percent of the year. The solar radiation which reaches the crowns of the trees is approximately 425 calories/square centimeter/day, of which 210 calories/square centimeter/day are utilized in the vaporization process and 215 calories/square centimeter/day are consumed in heating the air and other processes. This shows that vaporization and water balance are of great importance for the energy balance of the region (Salati et al., 1990).

The slight temperature variation is characteristic of the low sections of the basin, under 200 meters above sea level, while on the slopes of the mountains, especially in the Andes, the temperature varies from temperate to frigid in the highest zones. The seasonal rain cycle is also variable. In the north heaviest rains occur in June and July while in the south they last from November to March. To the west and northwest, rainfall is abundant throughout the year. In the Brazilian Amazon, the rains vary from 3,000 millimeters/year to 1,500 millimeters/year; they are heaviest on the coast, diminishing toward the center and increasing toward the northwest. On the eastern slopes of the Andes rainfall increases abruptly, exceeding in some areas 6,000 millimeters/year.

According to data now available, the basin as such contains between 15 and 20 percent of the world supply of fresh water and is one of the most important fresh water reserves on the planet. An important aspect, and of great ecological importance, is the fact that the hydric balance of the Amazon region depends in large measure on the basin's forest cover. An estimated 75 percent of the rains in the basin return to the atmosphere in the form of water vapor produced by evaporation on the leaves and transpiration of the plants (Salati et al., 1985). Thus, at a given point in the watershed, an average of 50 percent of the water which enters the system in the form of water vapor comes directly from the Atlantic Ocean, carried by the trade winds which blow all year from the east. The remaining 50 percent is produced by the evaporation and transpiration of the region itself (Salati et al., 1990).

Until now there has been no clear picture of the variability of the soils in the basin. Detailed studies carried out in San Carlos de Río Negro (Venezuela), Yurimaguas (Peru), and Manaus and Rondonia (Brazil) indicate that, as a result of the processes of *intemperismo* and lixiviation, the Amazon soils have lost much of their nutrients, reducing their capacity for ion interchange and their fertility. The flooded areas, which receive sediment from the rivers (*várzea* or *barreales*) annually, have fertile soils and are currently the best agricultural production areas of the region.

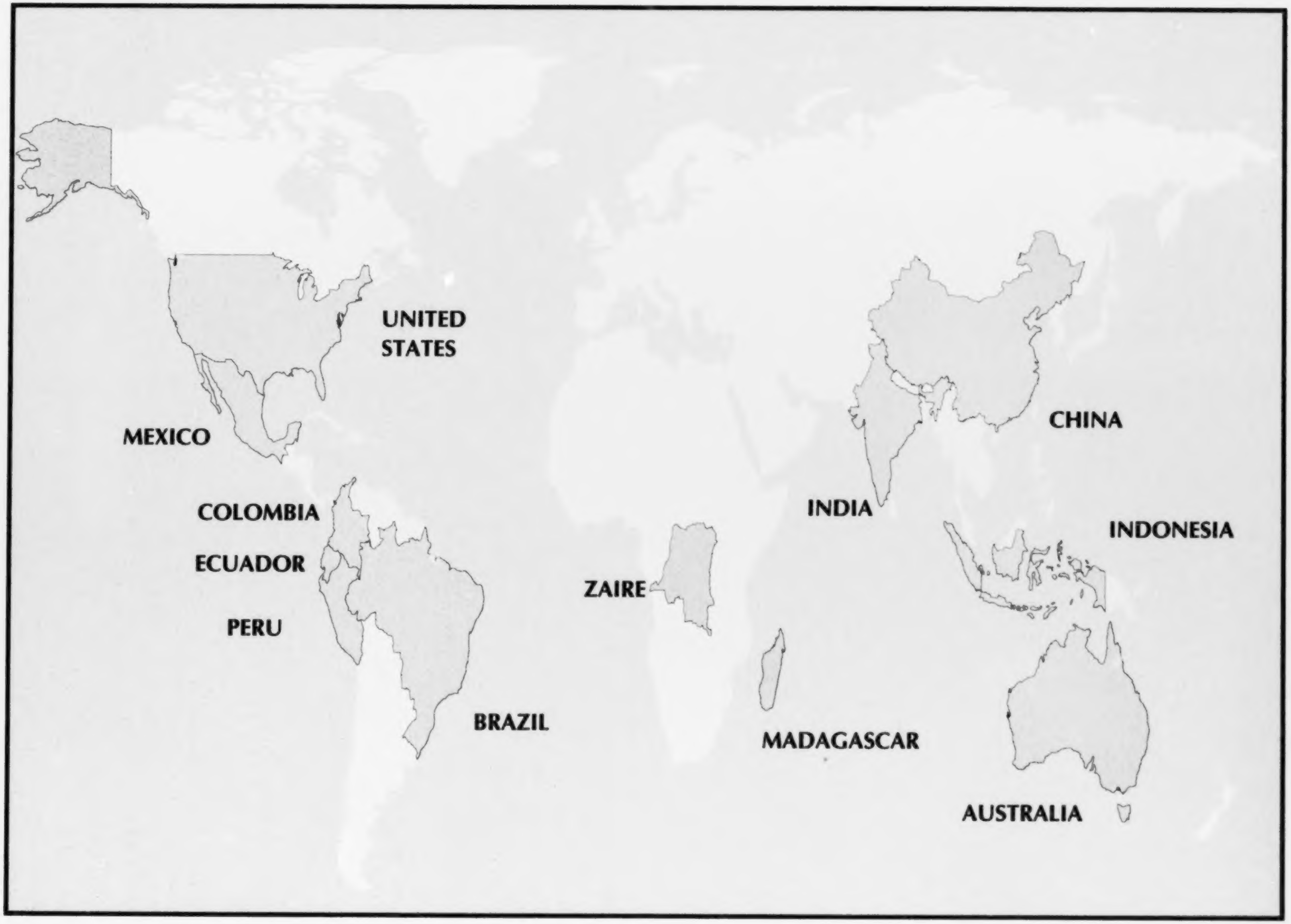
In the Brazilian Amazon, 45 percent of the area is covered by *Oxisoles*, 30 percent by *Ultisoles*, 7 percent by *Alfisoles* and the rest by youthful soils (*Inceptisoles* and *Entisoles*) and by *Vertisoles* and *Molisoles* (Vera and Santos, 1987; Dematte, 1988). According to other evaluations (Sanchez et al., 1982), 90 percent of the Amazon soils are deficient in phosphorous; 73 percent show aluminum toxicity; 50 percent are water deficient throughout the year and 24 percent risk flooding. On the peripheral mountain slopes, the local variation of the soil is extremely pronounced, with improved fertility but with a high risk of erosion due to heavy rainfall and complex orography. The edaphic heterogeneity determines a great variation in types of vegetation and in possible land uses (Sombroeck, 1990).

2.3 Biodiversity

The biological diversity, or biodiversity, of the Amazon region is the genetic variation which occurs in the nature of this biome and can be observed at three different levels: genes, species and ecosystems (McNeely et al., 1990). The genetic diversity is the assemblage of the genetic information existing in the species which constitute the flora, fauna and microbiota. The diversity of species is the number of such species, usually related to the different degrees of adaptability that the organisms present in relation to different habits or existing ecosystems. The diversity of ecosystems not only takes their number and frequency into consideration but the variety of habitats, biotic communities and ecological processes as well.

Biological diversity is one of the more conspicuous characteristics of the Amazon region. In global terms, existing species are estimated at between 5 and 30 million (Erwin, 1988), although in a recent discussion the number of insects was identified at a maximum of 10 million and more probably 5 million (Kevin, 1991). Of these, only 1.4 million are identified, of which 750,000 are insects, 40,000 are vertebrates, 250,000 plants and 360,000 pertain to the microbiota (Wilson, 1988). Although they cover only 7 percent of the earth's surface, Amazonia's tropical forests contain more than half of all biota (Wilson, 1988). As concerns the region, the following figures are generally accepted: 60,000 species of higher plants, 2,500,000 species of arthropods, 2,000 species of fish and 300 mammals (Salati, 1983).

Although from an airplane the Amazon region appears to be a uniform blanket of green vegetation, the vegetation is surprisingly heterogeneous. A distinction has been made between widespread formations and reduced formations. The former have an extremely dense biomass: forests with firm soil or "dense shrubbery" (thick forests; open forests without palm trees; open forests with palm trees; forests of vines; dry forests; mountainous forests), forests subject to flooding, or *várzeas* or *igapós*. Less frequent are


UNITED STATES
MEXICO
COLOMBIA
ECUADOR
PERU
BRAZIL
ZAIRE
MADAGASCAR
INDIA
CHINA
INDONESIA
AUSTRALIA

MAP NO. 3: MEGADIVERSITY—COUNTRIES WITH THE GREATEST BIOLOGICAL DIVERSITY OF SPECIES *Source: Mittermeier, 1992* forests with intra-Amazonian savannas (with firm soil; coasts; rupestrian countryside; savannah subject to flooding), the *caatingas*, the mangrove swamps, the *pirizal*, the *buritizal*, *aguajal* or *cananguchal* and the rock ledges (Toledo et al., 1988).

On the peripheral mountain slopes, especially those of the Andes and Guyana, the vegetal formations undergo modifications due to altitude and are identified fundamentally as cloud forests, dwarf mountain forests, the plateau, the moor, inter-Andean dry forests and formations of succulents. The vegetation interrelates in myriad fashions with the soil, the water and the fauna. The fauna cannot exist without the forest and the forest cannot exist without the fauna. The pollination and distribution of seed by the animals is essential for the survival of plant species.

The high degree of biodiversity in one place and the great differentiation of species between areas are the two biological factors that have the greatest bearing on the future of the Amazon region and sustainable development. The greatest diversity of organisms by area is found in the Amazon. There even exist astonishing differences between the fauna of insects found in the crowns of neighboring trees. The diversity of trees by area is greater in areas without seasons of the year and with abundant rainfall, between Iquitos and Leticia. The greatest number of registered species of trees is in Yanamono (near Iquitos, Peru) with 300 species of more than 20 centimeters in diameter at chest level (DCL) per hectare. The largest number of amphibian species in the world is recorded in Santa Cecilia (Ecuador); of mammals, in Balta, high Purus (Peru); of birds and butterflies, in Tambopata (Peru), and of reptiles, in Iquitos (Peru) (Gentry, 1986).

The biodiversity of the Amazon does not represent only exotic extremes of evolutionary diversification. This high biodiversity is correlated with an exceptional variety of useful species. More than 2,000 species of plants have already been identified as useful, the majority of them known to the indigenous peoples for their medicinal and nutritive properties and as producers of oils, greases, waxes, varnishes, aromas, tannin, saponin, latex, rubber, condiments, toxins, etc., and approximately 4,000 species are capable of maturation (Rutter, 1990, Table 4). In Iquitos (Peru) almost 200 species of fruit are consumed by the local population, the majority of them harvested in nearby forests (Vasquez and Gentry, 1989). The INPA has classified in its *xiloteca* (collection of wood types) 2,786 species capable of being ripened, distributed in 870 geni and 129 botanical families (Loureiro et al., 1979). In Brazil approximately 260 species have some economic significance and approximately 50 are marketed in significant volumes (Sternady et al., 1988). This large variety of useful products not only translates into improved nutrition for the local populace but indicates the economic value of the forest. The value of the wood, fruits and other natural products that can be extracted from one hectare of natural forest has been estimated as from 3 to 300 times that of cattle or nurseries. An estimated 90 percent of the economic value of the forest is also provided by a diversity of products other than wood (Peters et al., 1989).

A second aspect of the biological heterogeneity characterizing the Amazon region is the mosaic of different habits. Each substratum of soil has its own vegetal formation in that the species of the different substrata are almost totally different (beta diversity). For example, a series of samples made up of plants of more than 2.5 centimeters DCL on 0.1 hectares of forest with white sand lateritic soil, alluvial forest and areas flooded with dark and clear water demonstrates very few common species, of 3 to 20 species for each 200 species in each sample (Gentry, 1986).

Apparently in the natural forest many species adapt to a specific habitat, a factor which has had a direct bearing on development of the region. Seemingly, it is wiser to look for adapted species to grow in lateritic and white sand soils than attempting to grow rich soil species in unsuitable habitats. As obvious as it may seem, this is not done at present simply because the complex mosaic of existing substrata is not fully understood. For that reason, therefore, African palm, which grows successfully in rich soils, does not grow in poor soils. Likewise, the failure of cedar and mahogany plantations is due more to the need of these species for alluvial soil than to their susceptibility to attack by *Hypsiphila*, a moth whose larvae strip away the buds of the species. The rich soils of the Manu National Park (Peru), for example, produce an abundance of natural monospecific patches of cedar (Gentry, private correspondence).

Another important aspect of high biodiversity and of high differentiation of habitats is the complexity of interactions between species and habitats. The existence of the sylvan ecosystem depends on interaction between the plants and animals which pollinate the flowers and scatter the seeds. Many of these interactions are extremely specific and the loss of only one species which is an agent of pollination may effect many other species indirectly. This complexity has implications for sustainable development. For example, the pollinating bees required to produce the chestnut or the Brazil nut need alternative sources of nectar when the chestnut is not in flower. In Manu

WORLD COUNTRIES WITH THE GREATEST DIVERSITY OF SPECIES

AT GLOBAL LEVEL (Number of species)

	MAMMALS	
1.	Indonesia	515
2.	Mexico	449
3.	Brazil	428
4.	Zaire	409
5.	China	394
6.	Peru	361
7.	Colombia	359
8.	India	350
9.	Uganda	311
10.	Tanzania	310

	BIRDS	
1.	Colombia	1721
2.	Peru	1703
3.	Brazil	622
4.	Indonesia	1519
5.	Ecuador	1447
6.	Venezuela	1275
7.	Bolivia	1250
8.	India	1200
9.	Malaysia	1200
10.	China	1195

	REPTILES	
1.	Mexico	717
2.	Australia	686
3.	Indonesia	600
4.	Brazil	467
5.	India	53
6.	Colombia	383
7.	Ecuador	345
8.	Peru	297
9.	Malaysia	294
10.	Thailand	282

	AMPHIBIANS	
1.	Brazil	516
2.	Colombia	407
3.	Ecuador	358
4.	Mexico	282
5.	Indonesia	270
6.	China	265
7.	Peru	251
8.	Zaire	216
9.	USA	216
10.	Venezuela	197

	BUTTERFLIES[1]	
1.	Indonesia	121
2.	China	104
3.	India	77
4.	Brazil	74
5.	Burma	68
6.	Ecuador	64
7.	Colombia	59
8.	Peru	59
9.	Malaysia	56
10.	Mexico	52

	ANGIOSPERMS	
1.	Brazil	55,000
2.	Colombia	45,000
3.	China	27,000
4.	Mexico	25,000
5.	Australia	23,000
6.	South Africa	21,000
7.	Indonesia	20,0 00
8.	Venezuela	20,0 00
9.	Peru	20,000
10.	USSR	20,00

IN THE NEOTROPICAL REGION (Number of species)

	MAMMALS	
1.	Mexico	449
2.	Brazil	428
3.	Peru	361
4.	Colombia	359
5.	Venezuela	305
6.	Ecuador	280
7.	Bolivia	267
8.	Argentina	255
9.	Panama	217
10.	Costa Rica	203

	BIRDS	
1.	Colombia	1721
2.	Peru	1701
3.	Brazil	1622
4.	Ecuador	1447
5.	Venezuela	1275
6.	Bolivia	1250
7.	Mexico	1010
8.	Argentina	942
9.	Panama	907
10.	Costa Rica	796

	REPTILES	
1.	Mexico	717
2.	Brazil	467
3.	Colombia	383
4.	Ecuador	345
5.	Peru	297
6.	Venezuela	246
7.	Costa Rica	218
8.	Panama	212
9.	Argentina	204
10.	Guatemala	204

	AMPHIBIANS	
1.	Brazil	516
2.	Colombia	407
3.	Ecuador	358
4.	Mexico	282
5.	Peru	251
6.	Venezuela	197
7.	Panama	159
8.	Costa Rica	150
9.	Argentina	130
10.	Guyana	100

	BUTTERFLIES[1]	
1.	Brazil	74
2.	Ecuador	64
3.	Colombia	59
4.	Peru	59
5.	Central America	58
6.	Mexico	52
7.	Bolivia	44
8.	Argentina	38
9.	Venezuela	35
10.	Guyana/Suriname	31

	ANGIOSPERMS	
1.	Brazil	55,000
2.	Colombia	45,000
3.	Mexico	25,000
4.	Venezuela	20,000
5.	Peru	20,000
6.	Ecuador	15,000
7.	Bolivia	15,000
8.	Argentina	8,500
9.	Costa Rica	8,000
10.	Panama	7,750

SOURCE: McNeely et al., 1990.

[1] Large-tailed butterflies *(Fam. Papilionidae)*.

TABLE 4: USEFUL PLANTS OF THE PERUVIAN AMAZON

Use	Species		Total
	Classified	Unclassified	
Oils and waxes	34	2	36
Ornamental	84	6	90
Pottery	10	1	11
Utensils and tools	77	23	100
Varnish and tar	3	1	4
Beverages	30	5	35
Amulets and *chamaneria*	33	33	66
Scents and cosmetics	22	5	27
Tanning	17	—	17
Foods	446	76	524
Soaps	15	3	18
Fodder	10	2	12
Smoking materials and incense	14	5	19
Paper	1	—	1
Wood	318	83	401
Fuels	9	13	22
Caustic agents	7	1	8
Latex	20	1	21
Rubber	3	—	3
Agroforestry products	7	1	8
Cloth	3	1	4
Coloring products and dyes	65	45	110
Condiments	21	1	22
Construction materials	22	19	41
Toxic agents	308	26	334
Medications	2,449	764	3,213

SOURCE: Soukup, 1988; Rutter, 1990; Brack, 1991.

(Peru) the loss of a small patch of *Ficus trigonata*, which bears fruit during periods when other fruits are scarce, dramatically reduces the fruit yield of the forest. The use of the *várzea* or *tahuampa* for agricultural purposes, because of their fertile soils, may affect the region's fisheries by depriving them of reproduction and feeding areas.

The fauna of the Amazon basin is varied as to species and origin. In general, the bulk of the fauna has its origin in the basin which has been a vast center for the formation of biota and from which it has dispersed to periphery areas such as the Orinoco basin, the Maracaibo depression, the tropical wetlands of northern Colombia, the Pacific basin and Central America. The Andean periphery zones have fauna of Andean-Patagonian origin in their higher altitudes. In times past a fluid interchange of fauna has developed among the temporate regions of North America and the Amazon region through the isthmus of Panama, permitting an mutual enrichment of the fauna.

The variety of species is reflected in a high heterogeneity by area, where it is easier to find various, distinct species than two individuals of the same species. This variety is truly proverbial. In the crown of only one emergent tree in Madre de Dios (Peru) 5,000 specimens of insects have been found, of which 80 percent were new to the basin. Many studies confirm recent calculations that the Amazon houses several million animal species and that not even half of them have been identified (Erwin, 1988).

The aquatic environments of the Amazon house some 2,000 species of fish, as well as an important variety of mammals, birds, reptiles, amphibians and lesser groups, many of them widely used for different purposes. The fauna of the forest is extremely varied as to species of mammals (some 300 species), birds (more than 1,000 species), reptiles, amphibians and an extremely high variety of invertebrates.

2.4 The Distribution of Mineral and Energy Resources

Mineral and energy resources, widely distributed in the Amazon basin, offer good potential for economic development. Gold, bauxite, zinc, coal, manganese and iron are also found there, together with a large quantity of lesser minerals. There are also petroleum and natural gas deposits.

Gold has been mined in Brazil since the 17th century (Albuquerque-Rocha, 1984). Gurupí between Pará and Maranhão and Amapá and Rio Branco are recognized as gold-producing areas. The spontaneous search for gold, or *garimpagem*, intensified with the discovery in 1958 of the gold-bearing province of Tapajós. In 1979 this area was already producing 20 tons of mineral a year. At present more than 300,000 *garimpeiros* are spread over an area of 250,000 square kilometers, gold prospecting being one of the most important occupations in the Amazon today.

The mineral resources being worked on a large scale together with the hydrocarbons (oil and gas) are of signal importance in the Amazon basin. They include coal, bauxite (aluminum), iron, manganese, kaolin and zinc. The coal reserves in the Brazilian Amazon, although inferior to those found in the south, are not insignificant. The coal-producing basins of the Amazon are located in the Amazon River (Solimões), in the zone roughly between the cities of Leticia (Colombia) and Tefé (Brazil) and in the nearby Tocantins River basin. Bauxite is the most important mineral now being exploited in the region. Mines are located in the Trombetas River zone, with aluminum refineries in São Luis do Maranhão and Barcarena (Neto, 1990). The most important iron ore mine is the Carajás complex, around which a road network and other mining operations have developed. This high-cost project, using sophisticated machinery for the treatment of the ore and other minerals (Almeida, 1986; Salati et al., 1990) is of great economic and environmental significance. Its ecological and environmental complexity has created considerable controversy (Neto, 1990), for which reason it should more fully adapt to regional development needs.

Other minerals of lesser importance are manganese which is mined in the Serra do Navio en Amapá and in the State of Pará; kaolin, which is mined in Jari (Amapá), and zinc, which is mined in the States of Amazonas and Rondonia. In 1979 six areas in the Brazilian Amazon were selected as the sites of possible uranium deposits, although none has been explored, which indicates the limits of this resource in the region.

In the other basin countries, mining is of lesser importance, although the existence of gold, silver, lead, zinc and lesser metals is known (Dourojeanni, 1990). In Colombia a few years ago the discovery of important gold deposits in the Serranía de Naquén (Guainía) and the Traira or Taraira River on the Brazilian border was announced, as well as the Zamora region of Ecuador.

The mining of hydrocarbons is increasingly important in the region. Colombia, Ecuador and Peru discovered important Amazon deposits in the 1960s, although others had been discovered previously. In Bolivia oil and gas production was started in the Department of Santa Cruz several decades ago. In Peru, exploration in the Amazon has been carried out by Petróleos del Perú; proven reserves are 339,874,000 barrels with unproven reserves estimated at almost two billion barrels (Dourojeanni, 1990). In Brazil in 1987 oil and gas deposits were discovered in the Urucu River, a tributary of the Jurua River, and exploration has been carried out in Acre in the middle Amazon (between Manaus and Santarem) and in the mouth of the Amazon (Campos, 1980).

The largest hydroenergy reserves in the Amazon are situated on the Andean slopes where the gradient and the availability of hydric resources are greatest. For this reason, the Amazon basin accounts for 85.5 percent of the theoretical hydroenergy potential of Peru (176,287 MW) and more than 80 percent of that of Ecuador, (Dourojeanni, 1990). The lowlands have important reserves. Up to 44 percent of Brazil's unused hydroenergy potential (97,800 MW) is located in the Amazon, although the region itself consumes only 2 percent of the country's energy. The electricity consumption centers are situated at least 2,000 kilometers from the center-south network, which limits their economic attraction (Carvalho, 1987).

Due to the level topography, the dams in the region are immense. The Tucuruí dam on the Tocantins River covers an area of 2,430 square kilometers and will produce 4,000 MW in a first stage. The Balbina dam on the Uatumá River near Manaus floods 2,360 square kilometers of forest land and produces 250 MW (Salati et al., 1990). Currently in construction are the Samuel dam (650 square kilometers) on the Jamari River and the Ji Paraná dam (107 square kilometers), on the river of the same name, both in Rondonia. There are also 23 large- and medium-scale hydroelectric

SOME MINERAL AND ENERGY RESOURCES OF THE AMAZON BASIN
(adapted from PUTZER, 1984)

Mineral	Location	Reserves/ (Production)
BRAZIL		
Gema Salt	Manaus-Santarem	Undetermined 600 m thickness
Gypsum	Altamira	1 billion tons
	Itaituba	1.3 billion tons
Bauxite	Xingú-Manaus	approx. 4 billion tons
	Paragominas	1 billion tons
Kaolin	Manaus (Rio Negro)	500 million tons
	Rio Jari (Amapá)	365 million tons
Iron	Jatapu	80 million tons
(Itabirita)	Amapá	100 million tons
(Itabirita)	Carajás	19 billion tons
	Xingú (São Felix) and Naja River	100 million tons
Lignite	Javari River	Undetermined
Manganese	Serra do Navio (Amapá)	50 million tons
	Carajás	60 million tons
Copper	Carajás	1 billion tons
Nickel	Carajás	120 million tons
Diamonds	Maraba (Tocantins, Araguaia)	Undetermined
Zinc	Madeira River (Rondonia)	100 thousand tons/ (3,000 t./year)
Natural gas	Carauari (Jurua)	1.3 billion tons
	Pirapema (Amapá)	13 billion tons
Petroleum	Acre	6 billion tons
ECUADOR		
Petroleum	Aguarico	(12.5 billion tons/year)
COLOMBIA		
Petroleum	Orito (Putumayo)	(1.5 million tons/year)
PERU		
Petroleum	Ganso Azul	(9.5 million tons/year)
SURINAME		
Iron (Itabirita)	Tapaje	300 million tons

projects and at least 63 other sites have development potential, especially in Araguaia, Tocantins and other Amazon tributaries. These projects would flood an area 9.3 x 10^6 hectares (2 percent of the surface of the Legal Amazon, Fearnside, 1990) and would displace a population of 155,900 persons, of whom only 85,000 live in rural areas (Mougeot, 1990). Also, the Altamira complex on the Xingú River would flood 7,635 square kilometers (Belo Monte or Kararão and Babaquara dams).

2.5 Socioeconomic and Political Diversity

The Amazon basin is not socially homogeneous. Since arrival of the first inhabitants thousands of years ago, possibly in successive waves of migration, the aboriginal peoples have evolved, creating their own cultural patterns. The low areas of the tropical Amazon forests have certain cultural patterns in common with the riparian peoples and those peoples who live on land between the rivers, but they differ as to language and dialect. These groups endured internal pressures, conflicts and displacement before they came into contact with Western culture. Very different cultures have developed in the Andean zone around the periphery of the basins, such as the Aymara, the Quechua and the Chibcha, which have exerted influence over the aboriginal groups of the nearby jungle.

The discovery of America and European settlement brought other peoples who have adapted to the region and established relations with the aboriginal groups. However, integration has been limited while conflict and aggression have been the rule. Today the social outlook of the Amazon is extremely complex. There are indigenous peoples who have had no contact with Western culture, and others who have had extensive contact, as well as settlements of people of Andean, European, Asian and African descent. Some foreign immigrants of the last four centuries have adapted while others, the more recent arrivals, have adapted poorly to the regional environment.

The economic aspects of the basin vary widely from country to country, and ever within the Amazon portion of each country. In view of the growth of the Amazon population through immigration and reproduction, the region is assuming increased importance and is playing an ever larger role in the political and economic decisions of some countries. For Brazil, Peru, Bolivia and Ecuador, the region enjoys high economic priority; in Colombia, economic interest in the region is low, but growing; in Venezuela, the basin attracts almost no interest. The economic foci of the countries are also different. Some consider the Amazon a prime area for mineral development while others view it predominantly as a reserve.

Likewise, the history of the area has been such that the Amazon region, as a basin or as a tropical forest, has been considered peripheral for each of the countries. Despite its importance to several of the countries of the region as a percentage of national territory, the capital city of only one of the countries—Bolivia—is located in the basin, although on the Andean periphery.

2.6 The Amazon as a Political Unit

With signature of the Amazon Cooperation Treaty (TCA) in 1978, the basin countries (Bolivia, Colombia, Ecuador, Guyana, Peru, Venezuela and Brazil) and one peripheral country, part of the Amazon territory (Suriname), have begun to coordinate their programs and activities in the region. Through meetings of presidents and ministers pro-tem, the Amazonian Cooperation Council and the special commissions (CECTA, CESAM, CEMAA, CEAIA, CETICAM), they have coalesced into a dynamic coordinating unit which has attracted the interest of other countries and extraregional financing institutions.

Also, the Andean Pact countries, which have jurisdiction over 32.13 percent of the territory of the basin and comprise an important border and coastal component of the region, have coordinated their activities as they relate to the basin. These mutual efforts are designed to defend the political and territorial jurisdiction of the basin and thwart efforts by foreign interests to internationalize it. They are also designed to generate and coordinate regional proposals concerning the sustainable future of the region to the rest of the world, based on the countries' shared responsibilities.

2.7 Institutions in the Amazon

The constitutions of some countries have established institutions for the Amazon region, such as the National Amazon Research Institute (INPA) and the Peruvian Amazon Research Institution (IIAP). Other nations have established special constitutional guidelines and mandates for their Amazonian territories, among them Brazil, Peru and recently Colombia. In most cases the Amazonian institutions are established by legal, parliamentary or executive means and are subject to periodic policy changes. In other cases, institutions relating to the Amazon are tightly linked to international treaties or respond in part to the exigencies of these treaties and multilateral or bilateral agreements. Such is the case of the Amazon Cooperation Treaty (TCA), which has led to the creation of several commissions and coordinating groups, among them the Amazonian Parliament and Special Commissions on Science and Technology (CECTA), Health (CESAM), the Environment (CEMAA), Indigenous Affairs (CEAIA), Tourism (CETURA), and Transportation, Communications and Infrastructure (CETICAM).

On the other hand, rather than solving problems, several institutions, exceeding their objectives or following different agendas, generate or aggravate conflict due to lack of infrastructure, managerial incompetence or because they serve special interests such as the *garimpeiros*, indigenous groups, *seringueiros* or forestry associations, etc. Too frequently, resources are distributed without a cadastral survey or a territorial ordinance, giving rise both to conflict and to the plundering of the resources themselves. On the other hand, present systems of authority do not permit, or guarantee the participative access of the Amazonian population, for which higher levels of organization and new consultative mechanisms are required.

The superimposition of functions, so characteristic of both Amazonian and national institutions, requires legal restructuring to establish clear jurisdiction. There are many institutions engaged in the Amazon, both inside and outside the region—among them regional, national and international, governmental, non-governmental and private institutions, as well as base and support institutions. The existing governmental institutions are national, regional and local, sectoral and general, as well as those dedicated to aspects of science and technology, extension and training, management and education.

The national institutions are generally agencies of the central government and have jurisdiction over Amazonian affairs in aspects referring to research and technology (National Science and Technology Councils, National Agrarian Research Institutes, etc.), the use of Amazonian resources (National Petroleum Corporations, Forestry Services, etc.); indigenous affairs (Institutes for Indigenous Affairs, Agrarian Reform, etc.); environment (National Offices, Environmental Secretariats, etc.); planning (Planning Institutes or Ministries), etc. Generally these institutions carry out their activities through different sectoral Ministries, through regional and local offices in accordance with the political makeup of the country. The regional institutions headquartered in the Amazon include mainly the Amazonian universities and institutes. Operating with administrative and managerial autonomy, these institutions are engaged in research and promotion of the Amazon region, as well as regional development projects. The local institutions are generally agencies of different national and re-

AMAZON COOPERATION TREATY

The Amazon Cooperation Treaty (TCA) was signed July 3, 1978, by Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela to "adopt joint efforts and actions to promote the harmonious development of their respective Amazon territories in such a way that said actions might produce equitable and mutually advantageous results, as well as for the preservation of the environment and the conservation and rational utilization of the natural resources of these territories." This basic objective coincides with the concept of what is now called "sustainable development."

From the text of the treaty and other documents produced within the framework of the TCA since 1978 (meetings of ministers, declarations of presidents, etc.) policies and strategies have been developed which now serve as a model for the eight countries and which range from global aspects (sustainable development, sovereignty over resources, freedom of river transportation, biodiversity, indigenous affairs, etc.) to aspects of a technical nature. All this has constituted the conceptual, political and technical basis on which has been structured a series of programs and projects on which the countries will work jointly in coming years.

For their application, the Treaty establishes various procedures:

1. The Meetings of Ministers of Foreign Relations, as the level for the establishment of basic common policy directives and evaluation of the general execution of the process.
2. The Amazonian Cooperation Council, made up of high-level diplomatic representatives to supervise the fulfillment of the objectives and goals of the Treaty, as well as decisions taken by the Meetings of Ministers.
3. The Treaty Secretariat, exercised *pro tempore* by the country in whose territory the following Council meeting is to be held, as the executive level charged with carrying out the activities outlined in the Treaty in the Meetings of Ministers and of the Amazonian Cooperation Council.
4. The Special Commissions, as the operative level charged with studying and promoting activities on problems or specific themes, and which now total six (Environment, Science and Technology, Indigenous Affairs, Health, Transportation, Communications and Infrastructure, and Tourism).

The first period in which the Treaty was in force (1978-90) produced a substantial consolidation of political will and a growing process of definition and commitment concerning methods by which the development and conservation of the Amazon region, considered as a unit of shared responsibility and of harmonious occupation between the eight countries is to proceed.

Starting in 1990, the Amazon countries adopted measures to institute their commitments in a full and effective fashion through programs and projects to be carried out at the regional level under the coordination of the Treaty Secretariat, strengthened by a ruling approved in the Fourth Meeting of the Amazonian Cooperation Council (May of 1990). Finally, 52 programs and approximately 200 projects were approved, dealing mainly with the environment, science and technology, indigenous affairs, health, transportation, tourism and information; these now constitute a working mandate for coming years. The priority projects are concerned with the manner in which regional policies and strategies and the corresponding national policies are to be adopted and their effective application over time.

In each case the programs and projects must be carried out in cooperative fashion by public and private institutions independently selected by each country. The Treaty Secretariat and the Executive Secretariats of the Special Commissions generally coordinate and support the execution of the activities, contributing to the coordination and direction that in each case corresponds to an institution from a determined country. More than 100 public and private institutions from the eight Amazon countries are involved and committed to specific aspects of the TCA projects.

The international community is reacting favorably to the high priority that acceptable management of the Amazon region merits, and in something more than a year, starting in 1990, several organizations have started to lend their technical and financial support to various operations and projects, among them the UNDP, IDB, the World Bank, OAS, EEC, WWF, FAO, IUCN, ILO, the Rockefeller Foundation, UNICEF, ECLAC and the governments of the Netherlands and Canada. Conversations are under way with other organizations and countries which have demonstrated interest in supporting the Treaty.

gional ministries, such as local offices of the education, health, housing, agriculture and other sectors.

The political sector is present in different forms, depending on the country. Operating in the region are federal and state governments, regional governments with elected assemblies, local governments or municipalities, etc. The government institutions have several important characteristics and repurcussions in common. The most common include the duplication of functions and a lack of continuity. These defects are extremely frequent among national, regional and local institutions; they create confusion among the population and disrupt the order that underlies sustainable development. Some, for example, promote research and technology from a national point of view (National Institutes of Agrarian Research) while others are regional and operate from a partially regional point of view (Amazonian Research Institutes); others foster development through large projects at the national level (National Development Institutes or Corporations) and a few do so at the regional or local level.

The lack of continuity over time is due largely to the variability of the political priorities of successive national governments. The historic processes of Amazonian development in each country reflect a succession of institutions which appear and disappear, in accordance with political priorities. Until now no country in the basin has succeeded in structuring long-range policies, strategies and programs for Amazonian development which are not subject to continual change. Most Amazonian government institutions and those related to the Amazon face serious problems in regard to their finances, infrastructure and personnel, all of which reflect the economic and social crisis afflicting the countries.

Nongovernmental institutions related to the Amazon are local, regional, national and international in character and are staffed by citizens concerned with research and regional development in their capacity as civic, non-profit groups. They may be classified as grassroots institutions of "intellectual" cast. The grassroots institutions respond to the organizational needs of the population and represent important groups, generally organized by activity. Most of the indigenous peoples, for example, have organized into local associations and regional and national federations to defend their rights as ethnic minorities and, as in the case of COICA, have even succeeded in coordinating their efforts at the level of the basin as a whole.

The nongovernmental institutions of intellectual cast are associations and foundations that bring together citizens, generally professionals and researchers, for various purposes, among them environmental conservation and the protection of natural areas; training, extension and education, support of indigenous peoples, etc. Such institutions are growing in number; some are local and others national, with associated local groups. There are also international nongovernmental institutions, which may or may not be represented at the regional level, which attempt to influence and pressure international and national organizations, generally on behalf of the environment. Many are engaged in financing local and national nongovernmental institutions through concrete projects or by institutional means.

Existing private national and regional organizations pursue concrete objectives as private enterprises and associations of businessmen, miners, loggers, industrialists or exporters. Many are grassroots organizations which pursue economic interests of a corporate nature for the exploitation of natural resources and in defense of their rights.

Various official international institutions relate to the Amazon region through governments or private and nongovernmental institutions. In this group are international financing agencies (IMF, IDB, IBRD), government institutions (AID, ACDI, GTZ, ORSTOM, etc.), entities of the inter-American system (OAS and IICA) and United Nations organizations (UNDP, UNEP, ILO, UNESCO, FAO, etc.,) as well as religious organizations. The international financing, governmental and nongovernmental agencies finance development programs in the region almost exclusively through the regional governments and very seldom with private or nongovernmental institutions. The different United Nations organizations, in addition to supporting and financing national and private projects, fulfill an important function in international fora for the coordination of international agreements and treaties designed to resolve environmental, scientific and cultural problems, as well as problems of indigenous peoples and human rights, at the global level.

The various international agencies have still not adapted sufficiently to Amazonian reality in the following principal respects: (i) They demonstrate a lack of knowledge of Amazonian reality and of local needs, concentrating more on high priority global aspects in the developed countries. Concerns and needs in the Amazon region are often very concrete and are seen as only remotely related to the global scene; (ii) They often respond more to financial pressures and the pressures of groups in developed countries than to the integral solution of regional problems. For example, aspects referring to the conservation of biodiversity, to forestry conservation and to the commercial boycott of tropical woods too often have a "Northern" focus toward the South and are not attuned to the reality of the basin itself; (iii) They support government projects almost exclusively and lack the mandate to support programs of nongovernmental and grassroots institutions, thereby overlooking new, daring and interesting initiatives for sustainable regional development. In the past, support of large colonization and road construction projects by the international financing agencies has produced overblown failures and negative environmental results. Nonetheless, much more modest projects of the grassroots groups and of the NGOs involved in research, education, rescue of local technologies, traditional medicine, etc., have received insufficient support or none at all; (iv) A common defect of the international agencies is the wholesale contracting of international experts on the Amazon region and the bypassing of local experts who possess equally high professional qualifications. In this regard, priority concern should be directed toward assembling files of national, regional and local experts and using their knowledge and experience. Every day the conviction grows that many "international experts" are excellent generalists but impractical in local situations.

THE COORDINATING AGENCY OF THE INDIGENOUS ORGANIZATIONS OF THE AMAZON BASIN (COICA)

The Coordinating Agency of the Indigenous Organizations of the Amazon Basin (COICA) was founded March 26, 1984, in Lima (Peru) by the same national indigenous organizations to strengthen the ability to act and pool their work and experiences. It is composed of national organizations of Bolivia, Brazil, Colombia, Ecuador and Peru.

The Indigenous Confederation of Eastern Bolivia (CIDOB) represents 41 indigenous communities of the Amazon region of Bolivia with 11 affiliated organizations.

The Union of Indigenous Nations of Brazil (UNI) represents some 150 indigenous peoples of the Brazilian Amazon with 9 affiliated organizations. The National Indigenous Organization of Colombia (ONIC) has 30 national affiliate organizations. The Confederation of Indigenous Nationalities of the Ecuadoran Amazon (CONFENIAE) embraces 10 national organizations. The Interethnic Development Association of the Peruvian Jungle (AIDESEP) has 21 regional organizations.

COICA has prepared several proposals for Amazonian development financing agencies (*Our Agenda*, COICA, 1989), for the international community (*For the Future of the Amazon Region*, COICA, 1989) and the community of environmentalists. In the proposal for the Amazonian developing financing agencies (*Our Agenda*), five requirements are postulated (COICA, 1989):

1. "The best defense of the Amazonian environment is the recognition and defense of the indigenous territories and the promotion of indigenous models of coexistence with the Amazonian biosphere and the sustainable management of resources."
2. "Financing institutions should recognize the rights of indigenous peoples in accordance with the conclusions of the Working Group on Indigenous Peoples, which is an agency of the United Nations Human Rights Commission."
3. "Without the consent of the affected indigenous population, no development projects can be carried out in indigenous areas."
4. "If an indigenous population has given its consent to the implementation of a development project within its territory, the project must be designed in such a manner as to respect the territories, the economy and the social organization of this population as defined by the population itself, in accordance with the institutional policy in Point One."
5. "The financing agencies should establish a direct relationship of collaboration and mutual respect with the indigenous organizations through their representatives. This relationship should be the basis for continuous consultations; the participation of indigenous representatives in the planning, execution and evaluation of projects; and the interchange of information of mutual interest on plans, projects, activities and needs.

III

THE SETTLED AMAZON

The Amazon is neither empty nor uninhabited. More than 20 million persons live in the Amazon, among them inhabitants of the forest, indigenous tribes, river people, prospectors for gold and precious and semiprecious stones, city dwellers, farmers, cattlemen and foresters. They live in dozens of settlements and are engaged in multiple activities.

3.1 A Long Settlement Process

It is difficult to summarize the settlement of the Amazon from its earliest days. Two lengthy periods have been identified: settlement before and settlement after the year 1500, when the Europeans arrived. The early inhabitants did not know how to make ceramic products. Instead, they used perishable instruments of vegetable and animal origin which deteriorated rapidly in the warm and humid climate. Even the remnants of ceramics are difficult to find under the jungle cover. However, archeologists have used these remnants and linguistic evidence to reconstruct the prehistoric Amazon.

The date of the arrival of man in South America is calculated between 23,000 and 20,000 years ago. Some 10,000 years before Christ, hunters lived in the open plains of the Amazon and occupied the southern part of the region (Meggers, 1985). Definite evidence of settlement of the lowlands of the central Amazon does not exist until between 5400 and 3200 B.C. and is provided by the remnants of ceramics in the Madeira River. Ceramic remnants estimated to be between 7,000 and 8,000 years of age were recently uncovered at Santarem (Wilford, 1991). Remnants found in the mouth of the Amazon, the lower Tocantins and the upper Xingú are attributed to the preceramic era. Research in linguistic groups and the derivation of certain languages and dialects indicates that between 3000 and 2500 B.C. the primitive Caribs, the Tupí and Arawak began to divide into language families. The distribution of the Arawak-speaking groups, according to the early reports of the *conquistadores*, indicates that they occupied a wide area. Two general settlement routes have been identified: the Caribbean route, ascending the river and its principal tributaries from the mouth, and the Andean route in from the west. The first was the more important and the more successful.

Other peoples migrating from the Andes made contact with the Amazonian groups. Several indigenous pre-Incan Andean groups successfully occupied the forests of the slopes of the eastern Andes, as evidenced by numerous archaeological remains. The Incas penetrated the upper jungle sporadically and even relocated settlements there to harvest coca and as a form of punishment.

Large riparian populations existed along the Amazon at the time of the arrival of the first Europeans and were quickly decimated by the diseases introduced by the newcomers, against which they had no resistance (Arvelo-Jimenez, 1989; Compton, 1989; Chirif, 1989; Dominguez, 1989; Montero and Crespo, 1989). Modern settlement occurred in three well defined periods: territorial reconnoitering and settlement (1500 to 1840); exploitation of forests (1840 to 1945), and modern exploitation (after 1945).

During the first period (1500 to 1840), the Portuguese, who entered the region from the Atlantic, found densely populated settlements structured as independent villages. At the same time, the Spaniards, who occupied the region contiguous to the Andes, found more complex societies characterized by cities linked by roads. The gold and silver found by the Spaniards in the Andes and the legend of an Indian chief dressed totally in gold was the basis of the myth of El Dorado. This precipitated expeditions into the region, leading to the first trip to the Amazon River and its discovery in 1541 by Captain Francisco de Orellana.

Following the Spaniards, the English, the Dutch and the French attempted to establish colonies in the Amazon. They were blocked by the Portuguese, however, who from 1615 on established forts, religious missions and settlements to assure their control of the region. Initial attempts to establish settlements failed, after which development was confined to the exploitation of natural products, gold and precious stones. From São Paulo, the settlers travelled down the Tocantins, Guaporé and Madeira Rivers in search of gold, precious stones and Indians to use as slaves. Impact on the environment was minimal but the impact on the indigenous people was another thing; entire tribes disappeared, victims of disease and slavery.

Colonization intensified in the years 1840–1910 during the rubber "boom" as waves of immigrants arrived from Brazil, Peru, Ecuador and Colombia to grow and harvest the crop. Between 1840 and 1914 nearly 300,000 colonists of diverse origin migrated. The regional population increased from 137,000 inhabitants in 1820 to 1,217,000 in 1910. The first railroad, a 324-kilometer line between Madeira and Mamoré, was constructed between 1872 and 1912. New cities such as Porto Velho and Guajara-Marim were built while other cities such as Belem and Manaus expanded rapidly. The impact on the indigenous population was profound, verging on genocide as in the case of the Huitotos in northern Peru, and many groups migrated to the interior and toward the upper basin, pushed by the wave of settlers and to escape slavery. Livestock ranches established in the region met the same fate as the rubber growers, whose output declined from 1914 onward as English plantations in southeast Asia came into production.

The fall of rubber prices in 1914 brought development of the Amazon to a virtual standstill, not to resume until after the Second World War. Starting in 1946, development entered a third phase—one of intensive settlement characterized by agriculture, livestock and lumber operations. This stage, encouraged by governments, featured highway and airport construction, the mining of minerals and petroleum, the construction of hydroelectric dams, the relocation of peoples from impoverished and depressed peripheral areas and the clearing of large areas of land. As in the case of Manaus, the establishment of a duty-free zone permitted rapid city growth. During this period, deforestation increased at an accelerated pace. In Brazil alone, from 1975 to 1988 the deforested area increased from 29,342.2 square kilometers to 396,689 square kilometers (INPE, 1990), creating a profound environmental and cultural crisis (Salati et al., 1990).

The first penetration road into the lower Amazon was built in Peru between 1937 and 1943, to Pucallpa on the Ucayali River. Construction of the Marginal Jungle Highway started along the original eastern Andean piedmont or Upper Jungle in the 1960s. At present, approximately 8.5 million hectares have been cleared, large cities have sprung up in the region, and the non-indigenous population has grown from some 18,000 inhabitants in 1876 to about 3 million today. And in Ecuador, 13 Amazon "penetration" roads have been built or are under construction.

3.2 The Indigenous Peoples

Several millennia of adaptation have enabled the indigenous peoples to develop a thorough knowledge of ecosystems, plants and useful animals. They are able to identify the species of mature and young trees and their seeds, as well as the properties of the roots, bark, wood, leaves, sap, resins, flowers and fruits of numerous species. They have similar knowledge of terrestrial, arboreal and aquatic fauna.

The native Amazonians have developed complicated and varied technologies for the preparation of hallucinogens and plant-based poisons for hunting (curare), as well as animal-based poisons (amphibia) and ways to prepare and store vegetables and animal foods. Approximately 100 species of plants have been domesticated in the Amazon and nearby tropical zones. The most important of these are the yucca or manioc, of which there are sweet and bitter varieties. Up to 140 varieties of yucca have been cultivated. Yucca is the principal ingredient in 14 foods, and it can be used in the preparation of 13 kinds of beverages (Kerr and Clement, 1980). The natives have also cultivated and domesticated other plant varieties such as *camote* or sweet potato, peppers or *chiles*, pineapple or *ananas*, papaya, peanuts, beans, tobacco, etc. They keep aquatic turtles in captivity, store oil from turtle and manatee eggs, smoke the meat of wild animals and fish, etc. They accumulate knowledge of the customs of aquatic and terrestrial fauna, their seasonal migrations and their uses at different times of year.

The indigenous peoples of the Amazon have been classified by type, or culture, in accordance with the manner in which they have adapted and developed resource management systems. One group is composed of those who dwell on the dry land, another of those who live in the várzea or flooded zones, and yet another of inhabitants of the Andean piedmont (Chirif and Mora, 1980). Those tribes which live on dry land obtain an important part of their food from the cultivation of plants. To this end, they have developed agricultural systems based on burning the forest and planting the cleared lands, alternating short periods of cultivation—two or three years—with longer periods during which the forest is left to recuperate. The rotation system, which enables the soil to recover its fertility, is an efficient way to adapt to the low fertility of land which is not subject to flooding. In many instances the periods during which the land lies fallow and the forest is permitted to regenerate itself are complemented by the planting of useful trees and the harvesting of flora and fauna (Denevan and Padoch, 1990), as happens among the Bora. In addition to rotation agriculture, dry land cultures harvest forest and aquatic products, among them animals, plants, wood, fibers, fish, turtles, etc. Because of the predominance of farm products, especially yucca or manioc, and numerous fruits, this resource management system is very much in tune with the environment.

Those cultures which inhabit *várzeas* are represented by hunters and fishermen who periodically grow crops on swampy lands or areas subject to flooding. The yearly rise of the rivers results in flooding of wide areas of forest and the subsequent fertilization of the soil. Such lands lend themselves to the production of short-term crops such as peanuts, varieties of yucca with six-month maturation periods and plants resistant to flooding. In the past, these cultures lived mainly by fishing, collecting turtle eggs, and hunting turtles, caimans and manatees. The first Europeans in the region found large stocks of oil and yucca flour, as well as pens with live turtles. Today, with the decline in the number of wild animals, fish constitutes the main source of food for these people.

As the indigenous tribes of the *várzea* were the most numerous peoples of the Amazon, they developed ways to balance their population with available resources. These methods included infanticide, particularly of women; war with neighboring dry land peoples; the spacing of pregnancies; prolonged breastfeeding, and the use of plants for birth control.

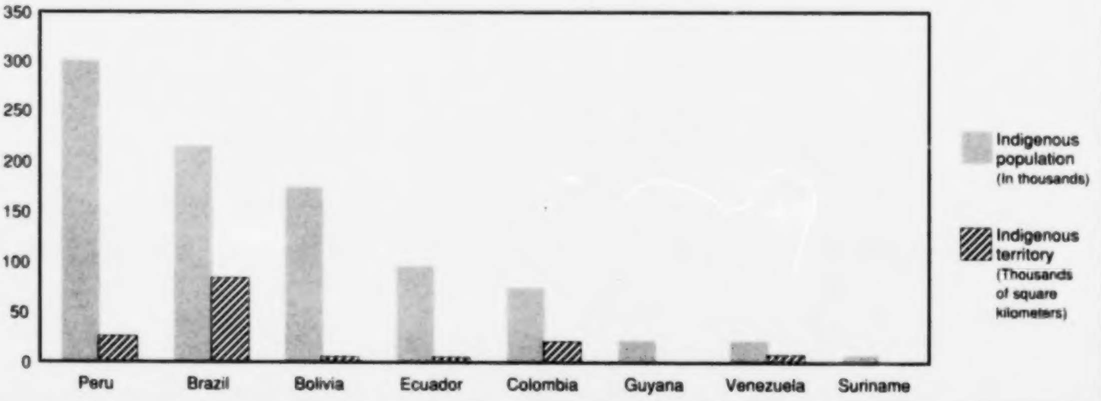
The Andean piedmont cultures were predominantly agricultural. The Andean rivers are fast and contain few fish. They do not flood their banks on a yearly basis. The fauna of the region, although varied, is not abundant. To compensate for these deficiencies, these peoples undertook long fishing expeditions in low-lying areas to replenish their food stocks. As these cultures at one time had access to important salt mines, they would maintain a brisk barter with lowland areas in this essential product. Some of these groups also maintained ties with the peripheral Andean cultures.

It is interesting to note that the rural Amazonian cultures of the past, as with outsiders who have adapted to the region, continue to follow these three development models. The inhabitants of the Andean piedmont are farmers, cattlemen and woodsmen; those from areas subject to flooding are fishermen, hunters and farmers of swampy soils; and those from the dry land are farmers and miners.

At the time of the conquest of America, the Amazon region was occupied by no less than 2,000 indigenous tribes with an estimated population of more than seven million persons (Denevan, 1976; Myers, 1988). Today, after surviving harsh conditions, approximately 400 ethnic groups totaling between 1.0 and 2.5 million persons remain (Jordan, 1990). This figure may be inflated, however, due to inaccuracies in the gathering of demographic data. Except in the case of Venezuela, which held an Indian census in 1982, data on the indigenous populations of the region was based on estimates provided by government agencies, religious missions and the like (Table 5).

The indigenous populations were decimated initially by new diseases (measles, chicken pox, influenza, etc.) and later by forced labor, especially during the rubber "boom." From the arrival of the first Europeans until well into the present century, it was

Figure 2
Indigenous populations and territories in Amazonia



generally accepted that the Indian was an obstacle, a savage, ignorant and inferior. Under the large Amazon settlement programs carried out until the 1970s, land was distributed for the harvesting of rubber, for agriculture, for livestock production and for lumbering without consideration for the indigenous tribes. Only recently, with advances in anthropological and social research and study, have the true cultural, technological and social values of the indigenous people begun to emerge. Anthropology and ecology have played an important role in revealing the excessive arrogance of Western science and technology, which deprecate pre-existing knowledge and even the inadequacy of prevailing scientific paradigms.

Today the indigenous peoples of the Amazon continue to suffer the impact of sporadic and planned colonization, of highway construction, of the prospectors and of the *culturizadores* who believe that the Indians must adopt Western culture if they are to be recognized as full citizens. In the process, many groups have disappeared. Others have been contacted or half contacted; very few still have not been contacted and are still living in their almost original state (Arvelo-Jimenez, 1989; Compton, 1989; Chirif, 1989; Dominguez, 1989; Montero and Crespo, 1989).

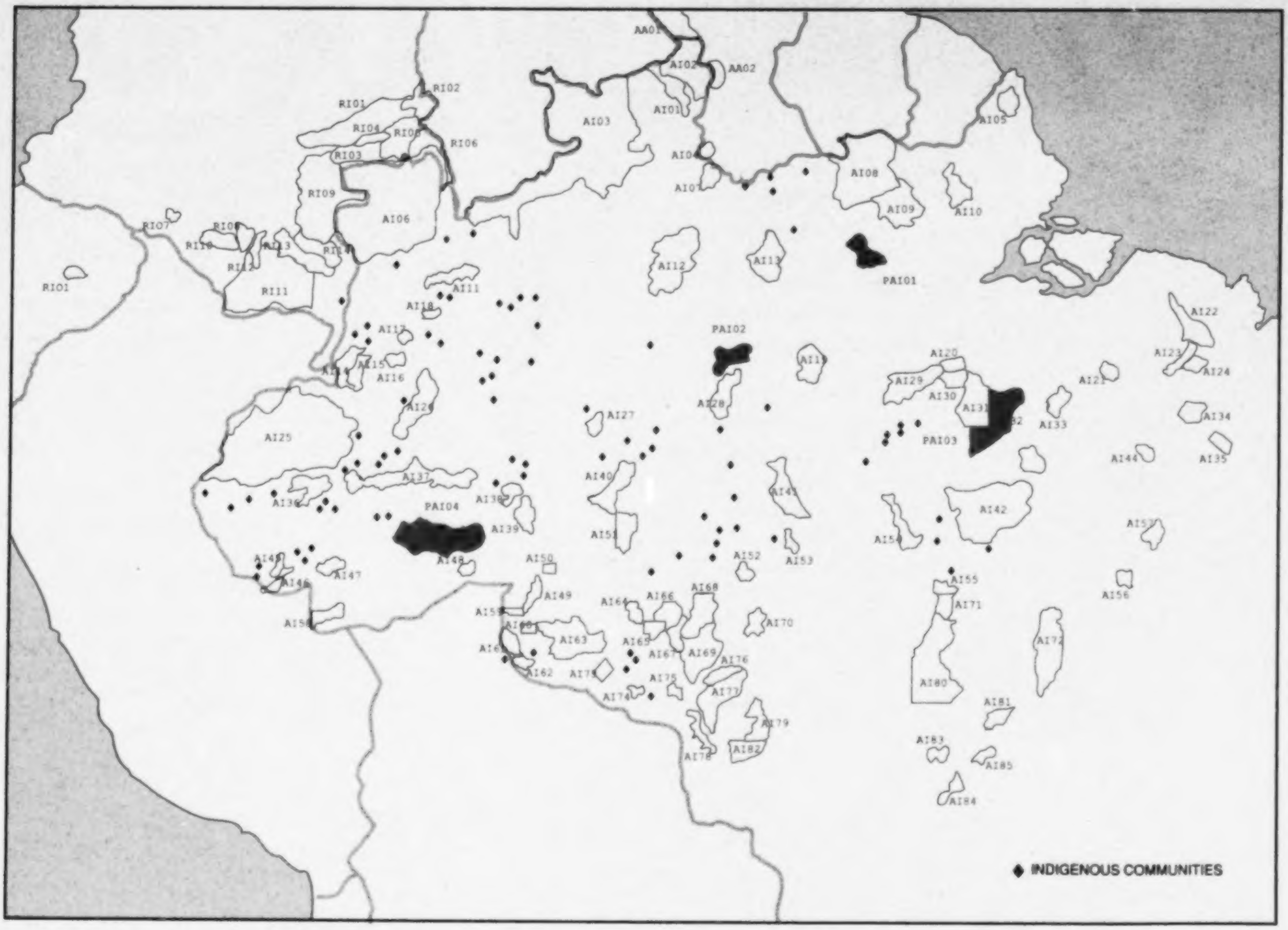
The majority of the countries have recognized the Indians' rights to land (Map 4), bilingual education and some organizational autonomy. However, most of the countries have still not recognized their right to more territory in accordance with the traditional use of resources, with the exception of the more traditional sectors of the Colombian Amazon (Bunyard, 1990) and, more recently, with the awarding of the Kayapó and Yanomami reservations in Brazil. The need for more territory for the traditional use of resources is imperative if integral development of the indigenous peoples is to be guaranteed, if they are to enrich their knowledge, language and ancestral technologies, and if their supply of forestry and fishery products is to be insured. Harmonious development of the indigenous peoples is not conceivable without more territory, due to their total interdependence with the environment. It is important that their ownership of soils and forest be recognized and that they be given exclusive use of the gold-bearing streams and beaches in these territories.

TABLE 5: ETHNIC GROUPS, INDIGENOUS POPULATION AND LANDS SET ASIDE FOR THEIR USE IN THE MEMBER COUNTRIES OF THE AMAZON COOPERATION TREATY

Country	Number of Ethnic Groups	Estimated Amazonian Indigenous Population	Extent of Lands Set Aside for Ethnic Groups (hectares)
Bolivia	31	171,827[1]	2,053,000[a]
Brazil	200	213,352[2]	74,466,149[b]
Colombia	52	70,000[3]	18,507,793[c]
Ecuador	6	94,700[4]	1,918,706[d]
Peru	60	300,000[5]	3,822,302[e]
Guyana	9	40,000[6]	n.a.
Suriname	5	7,400[7]	n.a.
Venezuela	16	386,700[8]	8,870,000[f]
TOTAL	379	935,949	109,637,950

SOURCES: [1] Bolivian Indigenous Institute, 1991. [2] CEDI/National Museum-UFRG, 1987. [3] Reichel (1987). The 1985 census reports only 46,367, but the 1973 census lists 57,496 indigenous people. [4] Uquillas and Davis (1991). [5] Peruvian Indigenous Institute. [6] Indigenous Census/Central Statistics and Information Office 1982. [7] Compton (1989) [8] Kloos (1972).

Notes: [a] Includes National Parks, hydrographic basins and the Permanent Production Forest of Chimanes, recognized as indigenous territories. The community properties granted under the Agrarian Reform Law have not been quantified. [b] The demarcation procedure includes several stages and, of the 518 indigenous areas involved in the demarcation process, 41 areas occupying 2,887,359 hectares have been completed; it only defines the Yanomami and Kayapó territories prior to December 1991. [c] Areas guaranteed in the form of indigenous reservations and protectorates. [d] Includes titled community areas and ethnic territories. [e] Only 2,152,205 hectares have been distributed as community property. The rest is ..., territorial reservations and communal reservations. [f] Includes the Upper Orinoco-Casiquiare Biosphere Reservation.



MAP NO. 4: INDIGENOUS AREAS IN AMAZONIA

Prepared by Conservation International

BRAZIL

Indigenous Areas

AI01	São Marcos
AI02	Raposa/Serra do Sol
AI03	Yanomami
AI04	Uaçá
AI05	Alto Rio Negro
AI06	Wai-Wai
AI07	Parque Indigena do Tumucumaque
AI08	Paru de Leste
AI09	Waiãpi
AI10	Uneiuxi
AI11	Waimiri Atroari
AI12	Nhamundá Mapuera
AI13	Tikuna Évare I
AI14	Tikuna Évare II
AI15	Vui Uata Nova Hália
AI16	Betânia
AI17	Uati-Paraná
AI18	Andirá-Marau
AI19	Arara I
AI20	Amaneyé
AI21	Alto Turiacú
AI22	Awa Gurupi
AI23	Carú
AI24	do Vale do Javari
AI25	Rio Biá
AI26	Coatá Laranial
AI27	Arara
AI28	Reserva Indigena Kararaô
AI29	Arawaté Ig. Ipixuna
AI30	Bacajá
AI31	Parakanã
AI32	Araribóia
AI33	Canabrava e Guajajara
AI34	Kulina do Médio Juruá
AI35	Deni
AI36	Jarawara
AI37	Caititu
AI38	Ipixuna
AI39	Mundurucu
AI40	Kayapó
AI41	Catetê
AI42	Apinayé
AI43	Kaxinawá do Rio Humaitá
AI44	Kampa do Rio Envira
AI45	Alto Rio Purus
AI46	Kaxarari
AI47	Karipuna
AI48	Karitiana
AI49	Tenharim/Transamazônica
AI50	Escondido
AI51	Kajabi
AI52	Baú-Mekragnoti
AI53	Capoto
AI54	Xerente
AI55	Kraolândia
AI56	Mamoadate
AI57	Ig. Lage
AI58	Rio Negro Ocaia
AI59	Pakaá - Nova
AI60	Rio Guaporé
AI61	Uru-Eu-Wau-Wau
AI62	Ig. Lourdes
AI63	Sete de Setembro
AI64	Zoró
AI65	Roosevelt
AI66	Aripuanã
AI67	Parque Indigena Aripuanã
AI68	Japuira
AI69	Jarina
AI70	Parque Indigena Araguaia
AI71	Rio Branco
AI72	Rio Mequens
AI73	Tubarão Latundê
AI74	Salumã
AI75	Nambikwata
AI76	Vale do Guaporé
AI77	Utiariti
AI78	Parque Indigena Xingú
AI79	Pimentel Barbosa
AI80	Paresi
AI81	Parabubure
AI82	São Marcos
AI83	Areões

Proposed Indigenous Areas

PAI01	Cuninapanema
PAI02	Mura
PAI03	Xingú/Bacajá
PAI04	Denido Ig. Sto. Antonio

COLOMBIA

Indigenous reserves

RI01	Cuenca Media y Alto Río Inirida
RI02	Ríos Atabapo e Inirida
RI03	Ríos Cuiari e Isana
RI04	Parte Alta Río Guainía
RI05	Tonina, Bejal, San José, otros
RI06	Bajo Río Guainía y Río Negro
RI07	Witora
RI08	Monochoa
RI09	Parte Oriental del Vaupes
RI10	Puerto Zabalo y Los Monos
RI11	Predio Putumayo
RI12	Arará
RI13	Miriti-Paraná
RI14	Vaigoje Río Apaporis

ECUADOR

Indigenous reserves

RI01	Huaorani

GUYANA

Amerindian areas

AA01	Upper Mazaruni
AA02	Karasabai
AA03	Kanashen

We must recognize that the countries are distributing land to the indigenous peoples (Table 5, Figure 2) but in a highly irregular fashion and not in accordance with their real needs and their meager participation in the programs.

The indigenous peoples have made substantial organizational gains at the national and international levels in recent years. At the national level, they have formed federations and confederations. At the international level, as already noted, the Coordinating Agency of the Indigenous People of the Amazon Basin (COICA) has been formed. Affiliated with the COICA are the Interethnic Development Association of the Peruvian Jungle (AIDESEP), the Indigenous Confederation of Eastern Bolivia (CIDOB); the Confederation of Indigenous Nationalities of the Ecuadoran Amazon (CONFENIAE); the National Indigenous Organization of Colombia (ONIC), and the Union of Indigenous Nations (UNI) of Brazil. In some instances, national indigenous organizations—particularly in Bolivia, Ecuador and Peru—have, jointly with federal agen-

THE VOICE OF THE INDIGENOUS PEOPLES

"The Indians and nature are one in our territories, one thing only, and it is for this reason that we the Ashaninkas ask land not only for ourselves but for the monkeys, the *huanganas*, the *anujes*. They also have a right to live."
Juaneco, Ashaninka chief, Peru

"These are the mountains and the rivers which give life to my people; this is the inheritance that we have received from our grandfathers, and I will kill myself for shame before looking into the eyes of our children when we have lost it."
Damián Tibijam, Aguaruna chief, Peru
(assassinated)

"They live in our lands and yet they mock us. They take for themselves whatever they wish and we must stand by while they ruin our soil. It is not possible to endure this and live."
Darío Nandureza, Guaraní chief, Bolivia

THE YANOMAMI LANDS IN VENEZUELA AND BRAZIL

After several years of unsuccessful attempts to create a binational agreement on protection of the Yanomami, Brazil and Venezuela issued separate decrees which constitute an advance in the protection of Yanomami rights.

On November 15, 1991, President Fernando Collor de Mello of Brazil ended a longstanding dispute by creating the Yanomami Indigenous Park. The park is the largest of its kind in Brazil and, with Kayapó Park, doubles the territory assigned to indigenous peoples during this century.

In August 1991, meanwhile, Venezuela's presidential decree No. 1635 created the Alto Orinoco-Casiquiare Biosphere Reserve. This reserve covers eight million hectares and includes the territory of the Yanomami and other zones, among them a segment of the territory of the Ye'Kuanas and, to the west, the Cerro de la Neblina National Park.

The creation of the park represented a victory for the Indians living in the territory and for the agencies which have supported them. In the case of Venezuela, the reserve offers certain legal protection to the Yanomami in that they cannot be relocated, the area cannot be divided, colonization is explicitly prohibited, and approval of the national executive is required to carry out any activity involving the use of resources. Still, the management plan outlined in the decree, which has not yet been edited, will determine the priority that will be assigned to protection of the Yanomami on the Venezuelan side. On the Brazilian side, the establishment of a large and contiguous area signifies, above all, the prevalence of Indian rights in the dispute. Earlier proposals would have established indigenous reserves around the settlements while opening the rest of the area to the exploitation of natural resources. Other interests, among them those of mining and lumber companies and certain political or military sectors in Brazil, must now be resolved in common accord with the indigenous authorities who have gained legitimacy in the process.

Other battles must be waged to achieve total protection for the Yanomami. Regulations must be enacted governing use of the areas and governments must lend their support to demarcation of the Yanomami territory. Also, the safety of the peoples in the future must be assured.

The governments could add a final grace note to the project were they to adopt the indigenous philosophy that, as the rivers of the Amazon flow freely without regard to borders, all elements of nature (including man) are interdependent. In the meantime, the governments should institute Article 32 of the Agreement on Indigenous Peoples and Tribes of the International Labour Organization (ILO) 1989 which reads: "*Crossborder Contacts and Cooperation.* The Governments will take appropriate measures, if necessary by international treaty, to facilitate crossborder contacts and cooperation between indigenous and tribal peoples, including activities in the economic, social, cultural, spiritual and environmental spheres."

Sources: Respective decrees of Venezuela and Brazil; Arvelo-Jimenez and Cousins (1991).

cies, undertaken important programs in the fields of educational, health, birth registration and land titling. The principal projections at the national and international levels are linked to recognition of their traditional territorial areas, administrative autonomy in organizational, cultural and education affairs; participation in decision-making on questions dealing with indigenous peoples, and conservation of the Amazonian environment.

COICA, on its own and through TCA, has presented proposals to international organizations and financing agencies referring essentially to improved defense of the Amazonian environment through recognition of indigenous territories and the promotion of indigenous models; consent of the indigenous populations in the execution of projects in their territories; respect for the territories, the economy, and the social organization of the territories in the execution of projects, and the establishment of a direct relationship with indigenous organizations through continuous consultation, participation and information interchange (COICA, 1989).

The indigenous people of the Amazon are currently engaged in a serious effort to preserve their identity, culture, languages, knowledge and technologies and to win recognition of their traditional territories and the right to the use of resources on an equal legal basis with the citizens of the respective countries. The General Conference of the International Labor Organization on June 29, 1989, adopted Agreement No. 169 on Indigenous and Tribal Peoples which is applicable to the indigenous peoples of the Amazon. If ratified by the Amazon states, this agreement will establish a new concept of indigenous rights at both the international and national levels. To date, only the governments of Bolivia and Colombia have ratified the agreement. It is also being debated in the Ecuadoran parliament.

Adoption of the agreement will replace the integrationist concepts which have shaped international and national law for the last 30 years and open a new perspective based on recognition of "the aspirations of these people to assume control of their own institutions and ways of life and their economic development, and to maintain and strengthen their identities, languages and religions within the framework of the States in which they live (ILO-Agreement 169).

The most important aspects of this international guideline involve recognition of these social groups as peoples in their own right, with their own identities and organizations. It also recognizes the duty of the States to guarantee them equality of rights and opportunities, eliminating socioeconomic differences with other elements of the community and insuring full respect for their social, economic and cultural rights. Agreement 169 emphasizes that laws must insure that the indigenous peoples enjoy the right of property, thereby strengthening claims to their traditional territories and guaranteeing them the right to use, administer and conserve the natural resources therein.

THE PROBLEM OF EDUCATION

Some time ago we lived in ignorance of the white man. We did not know how to speak Spanish. Later, with the arrival of the white man and the traders, the first Indians to learn Spanish became the guides of those white men. Many of these Indians did us a favor by leading the white men away from our areas, or warning us so that we wouldn't be killed. Others, however, willingly did the bidding of the white men, and we were enslaved by them. The era of the large rubber plantations arrived. The white men did not respect the Indians, they did not respect our women, they killed us. Later the older members turned over their sons. Merchandise arrived, as did clothing and finally money. The old rubber tappers died. The Indian overseers began to bring in the merchandise themselves. New traders and the overseers, together with other Indians that had learned from the white men, became the overseers of the new traders.

Later, 50 years ago, the priest arrived. Boarding schools were built. We labored to build them. The priests forced us to bring our sons to them to be taught. The boys were forced to remain there most of the year. They were not with their families, they did not learn from their fathers, they did not work with their mothers. Dancing was forbidden. At the boarding schools the children were beaten; they humiliated our sons if they did not behave as they were taught.

After 50 years, where is the teaching? What has it accomplished? What Indian has been trained as a doctor, a mechanic, a magistrate? Why don't the young people still obey their elders? Why aren't the young people interested in our tradition and our culture? Why have the people scattered in all directions and no longer live together?

Today we must teach and explain. We must make an effort to relearn our culture. That should be our main concern if we wish to continue to live well and in peace.

(Matapi, of the Miriti-Parana-Amazonas reservation, Colombia)

Article XIV of the Amazon Cooperation Treaty states that "the Contracting Parties shall work together to improve the efficiency of measures that may be adopted for conservation of the ethnological and archaeological riches of the Amazon region." In a general sense, this includes the indigenous peoples of the Amazon in the aforementioned treaty. In the Third

Meeting of the Foreign Relations Ministers of the Treaty (Quito, 1989), the Special Commission of Indigenous Affairs of the Amazon (CEAIA) was created, which, in successive meetings, prepared a substantial number of programs and projects on indigenous cultures, indigenous participation in the programs that affect their culture, government policy in indigenous communities, education, health, regional development and the indigenous communities, and the coordination of programming and regional information systems (TCA-CEAIA, 1991).

The legal framework of the TCA countries is not consistent from country to country with respect to the way the rights of the indigenous peoples are handled. The political constitutions of the different countries show various ways of handling their rights. In the Bolivian, Ecuadoran and Venezuelan Constitutions, only passing reference is made to the indigenous peoples, whereas the Brazilian, Peruvian and Colombian Constitutions, which are more recent, deal with them in greater detail. In the majority of the countries, problems surrounding the indigenous peoples, particularly those of the Amazon, are addressed through specific legislation and administrative regulations which recognize the indigenous communities as legal persons and acknowledge their right to legal recognition and demarcation of their lands. With the exception of Ecuador and Venezuela, the countries also recognize the inalienable right to the communal lands in perpetuity. Nevertheless, serious contradictions have continued to crop up between constitutional mandates and specific legislation promulgated in favor of the indigenous peoples, especially with respect to territory and to the use and management of natural resources.

3.3 The Contribution of the Indigenous Peoples of the Amazon

Raw statistics on the remaining Indian population as a part of the total population and the proportion of land in their possession provide the most patent demonstration of the innumerable fallacies that have grown up around the indigenous people and the deplorable manner in which they have been treated by an arrogant Western civilization. Certainly the indigenous peoples of the Amazon constitute a vital human resource as the region ponders its future alternatives. Their long and accumulated experience, now partially lost, as well as their knowledge, technologies and cultural attributes, form an intrinsic part of the treasure that is the Amazon and represent a major contribution of the region to the countries of the world. The Amazon and its indigenous peoples provide modern science with an unparalleled opportunity to advance the knowledge and technology required for the management of Amazonian ecosystems.

The Indians' knowledge of the biodiversity of plants, animals and germ plasm is a valuable tool for humanity. The Indians, in fact, have knowledge of thousands of useful wild and domesticated plants and hundreds of animals. They are also knowledgeable about environmental conditions that will be key to supplying the future needs of all humanity. Their agricultural, fishing and medicinal technologies are of great contemporary importance and, with the help of modern science, may be updated and modernized, thereby saving valuable time and resources otherwise spent on prolonged research and testing.

Doubtless the most important lesson that can be learned from the Indians is how they have coexisted and blended with the ecosystems, developing a lifestyle in harmony with their environment. In contrast, foreign cultures have achieved limited harmony with the environment. The quality of life of the Indian is not determined by economic gain at the expense of his environment. The qualify of Western life, on the other hand, is measured in economic terms and inflicts great damage on the environment.

The Indians form part of the cultural diversity of the Amazon basin and of the entire world, and must be saved. What a drab and sterile world this would be were it culturally, artistically and linguistically uniform. In light of the overwhelming problems facing mankind, created by the culture and technologies of self-described developed nations, the indigenous peoples, with thousands of years' worth of experiences, may provide the key to the solution of vitally important problems. Their claims to their lands, to their own culture, to bilingual education, to their organization and, finally, to all of their special needs, are justified not only as an act of justice or of compassion, but as a basic requirement of the Amazonian countries and of the entire world.

3.4 Inhabitants of the Forest

In addition to the indigenous peoples of the Amazon, other groups live in the forests, and of the forests, gathering vegetable and animal products for their sustenance and for sale in national and international markets. These peoples have adopted methods using resources which are in harmony with the environment and are comparable to those of the Indians. They are typical forest dwellers.

TESTIMONY OF EXTRACTIVIST PEOPLES
VOICE OF PEDRO RAMOS, RUBBER TAPPER

It began at the end of the 1950s and extended through the decades of the 1960s, 1970s and 1980s—and who knows to what year in the millennium 2000? At the beginning, we the extractivists helped many people from many parts of the country. Soon, however, we began to realize that a literal horde of people and merchants of the most varied sort, depending on the development model adopted by the government of the moment, were moving into all the states in the Brazilian Amazon.

They came and they stayed, drawn by the myth of an Amazon open to any type of venture and offering a chance for quick and easy wealth to whomever wished to invest and work there. Sponsored by the governments and international financial organizations, highways, ports and even hydroelectric complexes were built. Colonization and mining were encouraged, and, in the process, an unsound economic development model was adopted for the region.

At the same time,a general lack of understanding and an indequate legal system exerted a detrimental effect on the peoples of the forest (Indians and extractivists), the environment, on the ecosystems and on biodiversity. This was exacerbated by a lack of research in appropriate development technologies and preservation. The predictable result was social, economic and ecological conflict in which the Indians, the extractivists and the *posseiros* were the most profoundly affected.

We, the extractivists, subject to pressures of every type, began to develop ways to resist. In the midst of our suffering, we came to understand that it was not enough to merely endure, but that we must establish clear lines of political, institutional, social, organizational, judicial, ecological and economic action while forming strong alliances both at home and abroad. We decided to use our own social organization as a new model of development. Many of our children, prostrate with hunger and disease, were becoming delinquents in order to survive; young girls prostituted themselves for food or clothing or for hammocks in which to sleep.

Chico Mendes left the forest to publicly advocate a new development model for the Amazon. In 1985 we founded the National Council of *Seringueiros* involving a growing number of Amazon states. Our proposal is presently outlined in the Extractivist Reservations, which are based on a self-sustainable development model which, in turn, is based on a balance between man and environment, man and biodiversity and man and technology. This vision should be inculcated into scientific research which recognizes the historic experience accumulated by the peoples of the forest and values the unity of man with the earth and the earth with man. The extractivist and indigenous reservations have their own model of agrarian reform, in which spatial demarcation takes into consideration historic idiosyncracies in the use of natural resources needed for the survival of man in the forest. These idiosyncracies should also be taken into account in the fields of health and of education. Our wish is that the extractivist reservations be created, implanted and functionally regulated and that social and economic welfare be fostered not only for us the extractivists but for all society. It is for this reason that we wish to contribute to self-sustainable development.

In the end, God created the earth, and from his flesh he made man in his likeness. Nature adapted him, perfected him, endowed him throughout history with increasing amounts of knowledge, to be expanded through science and technology. Man continues to make new scientific and technological discoveries and constantly seeks to expand on this knowledge. Until now, man has not created his own raw materials; everything that he thinks that he has discovered, nature has given him, because everything that he did or does already existed. Man has only molded the pieces and adapted them, creating his new invention. He is the likeness of that which God created; but only the likeness, neither better nor worse. For that reason, take care, men of earth. No matter how much scientific knowledge you may possess, do not pretend to be equal or superior to the creator; do not wish to destroy or defy him who created you, adapted you, swathed you and gave you life.

They are of diverse origin. Generally they are migrants who have adapted to the region, transculturalized Indians or mestizos of Indian and migrant blood. Many are descendants of the rubber workers or *seringueiros* and of natives of the rubber-production era at the end of the last and start of the present century. In Brazil they are known as *seringueiros* or *ribeirinhos* or, collectively, as extractive people, and in Peru as dwellers on the river bank, vendors of chestnuts, *shiringueros* or *mitayeros*, in accordance with their occupation. They are subsistence farmers who employ the rotation system. They are also fishermen and hunters. But mainly they gather produce for domestic and international markets. They produce chestnuts or nuts in Brazil, rubber, hides, fish, the meat of wild animals and many other products derived from the biodiversity of the forest and Amazon waters (oils, waxes, fibers, medicinal plants, glues, resins, fruits, etc.) They can be described as modern harvesters of the useful biodiversity of the Amazon (Oyama, 1983).

Although they speak Western languages (Spanish and Portuguese), their adaptation to the jungle and

TABLE 6: PRODUCTS OBTAINED IN ONE HECTARE OF FOREST LAND BY EXTRACTIVISTS LIVING ALONG RIVER BANKS IN MISHANA, NANAY RIVER, PERU.

Common Name	Trees/Hectare	Yield/Year	Value US$
FRUIT TREES AND OTHERS			
Aguaje	8	88.8 kg.	177.60
Aguajillo	25	30.0 kg.	75.00
Charichuelo	2	100 fruits	1.50
Leche huayo	2	1,060 fruits	70.67
Masaranduba	1	500 fruits	3.75
Naranjo podrido	3	150 fruits	112.50
Sacha cacao	3	50 fruits	22.50
Shimbillo	9	200 fruits	27.00
Shiringa	24	2 kg.	57.60
Sinamillo	1	3,000 fruits	22.50
Tamamuri	3	500 fruits	11.25
Ungurahui	36	36.8 kg.	115.92
TOTAL	117		697.79
COMMERCIAL WOODS			
Aguano masha	4	0.55 m^3	4.88
Almendro	1	0.08 m^3	0.71
Azúcar huayo	1	0.10 m^3	0.89
Cumala	83	19.77 m^3	225.38
Espintana	7	1.47 m^3	18.52
Favorito	2	3.90 m^3	34.63
Ishpingo	4	0.82 m^3	7.28
Itauba	3	0.29 m^3	2.57
Lagarto caspi	2	0.25 m^3	6.04
Loro micuna	1	1.37 m^3	12.17
Machimango	5	0.76 m^3	9.19
Machinga	10	24.61 m^3	218.53
Moena	6	0.75 m^3	18.90
Palisangre	1	0.27 m^3	2.39
Papelillo	1	1.19 m^3	10.57
Pashaco	19	4.19 m^3	37.21
Pumaquiro	12	10.22 m^3	90.75
Quinilla	34	9.18 m^3	175.15
Remo caspi	28	11.65 m^3	103.45
Requia	4	1.60 m^3	9.41
Tortuga caspi	1	0.13 m^3	1.15
Yacushapana	2	0.71 m^3	6.31
Yutubanco	2	0.53 m^3	4.70
TOTAL	233	93.85 m^3	1,000.78

Source: Peters et al., 1989

their contact with the indigenous peoples have made them partially polyglot or have enriched their Western vocabularies with local expressions native to the areas in which they reside. As a result, some of this local terminology has been adapted at the world level and today it is impossible to write about the Amazon without using terms such as *várzea, restinga, igapó, guaraná* and *pirarucú* (Brazil) or *mitayo, purma, sachavaca, ayahuasca* and *aguajal* (Peru), etc.

They generate considerable income at the local, national and regional levels. Locally, they produce large quantities of food (fish, fruit and flesh of wild animals), as is the case at Iquitos, which is supplied yearly with more than 13,000 tons of fresh and cured fish. They also supply national and international markets with products such as rubber and the chestnut or Brazil nut. The production of Brazil nuts is estimated on the order of $200 million a year in the whole basin, especially in Brazil, Peru and Bolivia. They provide approximately 170,000 tons a year of fish to cities and small towns in the basin itself (TCA-FAO, 1991). The size of the Amazon population engaged in extractivist activities is hard to gauge, but it definitely represents a sizable portion of the rural population.

In light of growing international interest in Amazonian biodiversity, in which international industrial enterprises are becoming increasingly involved, these extractivist peoples have gained certain importance. They will become much more important in the future, however, especially as regards the plants and animals with medicinal, aromatic, hallucinogenic and nutritive properties.

National and international researchers have begun to concern themselves deeply with these people of the jungle. Furthermore, they are winning daily recognition for their economic contribution, as well as the way in which—in contrast to foreign agriculture and livestock systems—they manage the natural resources of the Amazon. In Peru, for example, large sums of money have been invested in the last 50 years to develop livestock which now amount to some 9,000 metric tons of beef a year. At the same time the

MANAUS: FROM 1848 TO THE PRESENT

Manaus, historic Amazon capital, symbol of the opulence of the rubber "boom" and a city of 1.6 million inhabitants, represents a terrifying picture of socio-urban reality.

Manaus was founded in 1848 with 4,000 inhabitants. Starting in 1880, with growth of the international demand for rubber, Manaus became the most important marketing center in the western Amazon. The urban plan prepared by Eduardo Ribeiro in 1892 involved the construction of avenues, public buildings and European-style infrastructure, which made Amazonian society forget the Indian occupation. But the rubber economy collapsed as national production fell 50 percent in 1910 and dropped to a dismal 5 percent in 1929. The boom was over and with it the dreams of thousands collapsed.

Law 3176 of June 6, 1957, converted Manaus into a free port (ZFM). Ten years later, Law Decree 288 of February 1967 established the special incentives which for 30 years would help create an industrial, commercial and agricultural center in the interior of the Brazilian Amazon. Law decree 356 of August 15, 1968, extended various of the ZFM incentives to the so-called western Amazon, comprising the states of Amazonas, Rondonia, Acre and Roraima, which cover an area of 19 million square kilometers, or 26 percent of the Brazilian national territory. The 1988 Brazilian Constitution ensured the availability of the fiscal benefits of the ZFM until the year 2013. Among the objectives of the ZFM was the decentralization of industry and the "interiorization" of development, transforming Manaus into an export pole and an international marketing center. In addition, it anticipated the creation of a tourist pole and free trade areas on the borders of Colombia and Peru (Tabatinga) and Bolivia. The ZFM incentives included tax exemptions on industrial products and on the exportation of services and income. Following establishment of the ZFM, the population of the city of Manaus increased from 245,000 inhabitants in 1967 to almost two million today, expanding haphazardly in all directions and invading forest areas. However, new industries which created scarcely 1,000 jobs in 29 years were incapable of absorbing the great migration of *caboclos* who descended on the city from the interior, and Manaus became an enormous *favela*. As the city continues to grow virtually without the benefit of urban planning, public services such as garbage collection, water and electricity have failed badly to keep pace.

The Amazonian population is paying a high price for this modernization and in so doing is denying its reality and its values. The millions of inhabitants of the State of Amazonas are converting the forests into wastelands and the small cities into *favelas*, creating grave problems for the future.

Sources: Free Zone of Manaus. Second International Conference of Free Zones in the Americas. Presidency of the Republic, Secretariat of Regional Development, Superintendency of the Free Zone of Manaus; Newspaper *Amazonas em Tempo*, December 14, 1991, pp. 4-5.

extractivists are producing yearly some 31,000 tons of protein in the form of fish and some 13,000 tons in the form of wild game (Dourojeanni, 1986).

Regional specialists in forest management and hydrobiological resources are forced to incorporate "scientific extractivists" into their working groups for their knowledge of trees (called *materos*), of fauna (called *mitayeros*), of hydrobiological resources, etc. Social science researchers, ecology researchers and gradually, forestry, agronomy, fishery and economics researchers are discovering a series of production systems based on the existence, rather than the destruction, of the forest. These systems are of great value in integral management of the Amazon forests and waters.

Studies of riparian populations (Hiraoka, 1985, 1989; Padoch et al., 1985) reveal a detailed system for the use of hydrobiological, agricultural and forestry resources for self-sufficiency and for local and regional markets (Table 6). Studies of nut and rubber extractivists in Brazil provide interesting data. Extractivist systems may provide one solution to the problem of integral management of the Amazon forests, the heterogeneity of which is considered an impediment to their development, from the point of view of external technology suitable to homogenous forests. The intensification of studies of the extractivist systems and their economic viability as regards imported livestock, agriculture and forestry techniques will, in the future, clarify many aspects of sustainable development systems in the Amazon.

3.5 Farmers and Settlers

During the present century, especially in the last 50 years, several governments undertook large road and development projects into, and within, the Amazon region, slowly at the start and, from the 1970s onward, at an accelerated pace, many of them partially financed by large international loans. The object of these development projects does not differ markedly among the countries: to integrate the region into the national economy; to settle the "extremely rich" region and transform it into "a food dispensary"; to secure national borders and a live presence in the region; to take advantage of renewable and nonrenewable natural resources, and to transfer excess population from impoverished and crowded peripheral regions.

Currently, 20 percent of the Amazon population may be considered farmers or *campesinos*. The proportion of rural inhabitants is decreasing rapidly in relation to the urban population. The majority of the peasants are poor farmers, working small plots of land and often lacking deeds to their properties. They are engaged, as we have noted, in migratory, rotative farming—on their own farms, if they are property owners, or wherever they can work. The origin of these farmers varies. Some came to the area as part of large state colonization programs which later failed; others moved in spontaneously, settling haphazardly along highways opened by the state or on the outskirts of settled areas, generally on land unsuitable for agriculture. Another group owns and works medium- or large-scale holdings; these farms and ranches are productive year-around units that use fertilizers and more advanced technologies. The owners of these small- and medium-scale properties, many of them farmers of European origin who settled in the upper Amazon, offer examples of highly successful sustained agricultural development. Many riparian farmers, in Brazil and Peru, are equally stable in that their properties are more clearly defined than those of new settlers. In the Amazon, too, of course, there are large property holdings, most of them unproductive because they were acquired for speculative purposes. Large land holdings in the region also belong to major national and transnational corporations, although such properties are rare in all the countries. The *campesinos* of the Amazon generally lack basic services, but when they acquire some work experience in the region they usually develop a better life style than they enjoyed "back home." When such is not the case, because of bad economic policies which depress agriculture, highly profitable illegal activities can result, such as the production of coca, common in the middle Amazon of Bolivia and Peru.

3.6 Urban Inhabitants

It is rarely understood today that the bulk of the Amazonian population is urban and that, from the point of view of the affected majorities, the principal environmental problems of the Amazon are those of urban sanitation. The Amazon, without including the peripheral zones of the basin, has numerous cities and towns, the urban population constituting between 50 and 60 percent of the total population. Most of the large population centers are relatively old, having been established during the colonial era or during the years of the rubber boom. Others are more recent, especially those located in the colonization areas. The population of the principal cities comprises a mosaic of races of different origins. In some zones where gold and other minerals are being mined, new towns are developing, often almost overnight.

In Peru, for example, the eight principal Amazon cities house 30 percent of the region's total population while the urban population comprises 48.86 percent of the total (Webb and Fernández Baca, 1991). Brazil is noteworthy in having the most populous cities in the region, namely Belem and Manaus, both with more than one million inhabitants. All the cities face the same basic problems: rapid growth, deficient basic sanitation services and the spread of slums.

Some cities have suffered more than a fifty-fold increase in population since 1940, creating a staggering deficit of basic water, sewage, garbage and electricity services. Inadequate hygienic services have permitted the propagation of infectious and contagious diseases such as cholera, as well as others such as dengue which are transmitted by insects. A few of the larger cities—among them Manaus and Belém in Brazil, Santa Cruz in Bolivia, Iquitos and Pucallpa in Peru and Leticia in Colombia—have become important industrial or commercial centers, due in large measure to incentives established by their respective governments. Rapid city growth has produced a proliferation of slums inside and around the urban centers, with the predictable consequences of insecurity and poverty.

Energy is produced by thermoelectric plants in most cases due to the lack of hydroenergy potential and investment in the lower Amazon. As a result, electricity is expensive and in short supply for both the general population and industry. The region has substantial international communications. Three cities (Belém, Manaus and Iquitos) are important ports and five (Santa Cruz in Bolivia, Iquitos in Peru, Manaus and Belém in Brazil and Leticia in Colombia) have international airmail connections.

3.7 Prospectors for Gold and Other Minerals, or *Garimpeiros*

It is little known that the Amazon is an emporium of mineral resources, including bauxite, cassiterite, iron, gold, nickel, precious stones, beryllium, copper, phosphates, etc. Gold exists almost everywhere throughout the region and reserves of the metal are calculated at 3,000 metric tons (Santos Bastos, 1984; Dourojeanni and Jorge Padua, 1991).

From the first Europeans who entered the Amazon in pursuit of gold and cinnamon, enticed by the legend of El Dorado, until today, the search for gold and other minerals has been almost constant in the region. There have been several "gold rushes" and "booms" as the search for precious metals and stones gained momentum. The best known were the search for cassiterite in Rondonia (Brazil), which attracted almost 50,000 migrants to that territory, the gold "boom" in the Serra Pelada in Brazil, and the gold rush in the Pachitea River (Peru) which drew approximately 30,000 prospectors.

Recent years have seen the development of a veritable gold fever. The phenomenon of the *garimpo* in Brazil and of the panners for gold in Peru is attracting the attention of politicians, sociologists and environmentalists because of the economic importance and the social and environmental problems that it creates. Starting in the 1980s, the boom was stimulated by the high price of gold in world markets; improved access to the region by road and plane, advances in radio communications, the upgrading of sanitary services, widespread poverty in peripheral areas, new technologies for panning for gold, and political decisions favorable to settlement of the Amazon.

The *garimpo* phenomenon has had a considerable social impact in Brazil. Data on the number of persons engaged in gold prospecting varies widely (Dourojeanni and Jorge Padua, 1991). However, it oscillates between 1 and 2 million persons operating 25,000 pieces of equipment and working over 160 million hectares. The number of people involved in all aspects of the work is even more difficult to gauge. The *garimpeiros* require construction and maintenance services, commerce, logistical support (fuel, oils, mercury, chemicals, foods and medicines); highway, river and air transportation; banking, medical and security services, and even prostitution. An estimated one million persons or more work in the *garimpos* and 30 percent of Brazil's Amazonian population is believed to be directly or indirectly connected with the *garimpagem*.

Available information on the other countries is even less precise. An estimated 30,000 persons prospect for gold in Madre de Dios Department in Peru. In Ecuador, Bolivia, Colombia, Guyana and Venezuela gold prospectors exert a strong influence in certain zones. Brazilian prospectors have penetrated into the other Amazon countries.

Brazil's official gold production in 1989 was 48.9 metric tons; unregistered production is estimated to be even higher. The USAGAL-FAMA (Federation of Auriferous Syndicates and Associations of the Amazon) reports unregistered production at some 100 metric tons a year. Other sources estimate it at up to 300 metric tons a year—production on which no taxes are paid. Gold mining is by far the most important economic and social activity in the Brazilian Amazon.

Invasion of the territories of the indigenous peoples is flagrant throughout. The main transgressors are informal gold prospectors who take over zones with or without authorization, as the miners' claims are considered more important than the Indian territories due to the lack of coordination between the respective sectors. On other occasions, the prospectors make arrangements with the Indian chiefs to search for gold in their territories. The most celebrated case of an invasion of indigenous lands is that of the Yanomami (Roraima, Brazil), considered one of the most important cases of human rights violations in modern times or since the era of the rubber boom. In this instance, more than 45,000 *garimpeiros* invaded Yanomami territory, assassinating the Indians, spreading disease and plundering the natural resources of the indigenous people.

Mining activities, for gold and other minerals, is exacting a heavy social price in the Amazon in the form of increasing population pressure, the alteration of Amazonian life styles, the suspension of development plans, and the propagation of disease, insecurity and corruption (Dourojeanni and Jorge Padua, 1991). No other factor has produced as large a migration of people to the Brazilian Amazon in so short a time as the gold fever. The same phenomenon will very probably occur in other Amazon countries, as has already happened in southeastern Peru. In Brazil thousands of people have moved into virtually uninhabited regions in a very few months. As the gold fever subsides, the prospectors move on, leaving scores of abandoned shacks in their wake. Such was the case after the great oil explorations in Peru in the 1970s. The traditional patterns of life of the inhabitants, especially the riparian peoples, are undergoing dramatic change as they are contracted by the *garimpeiros* as guides, to supply transportation and food, for prostitution, and other purposes. Abandoning their traditional occupations as farmers and extractivists, many young men are separated from their accustomed surroundings. The introduction of new foods and other goods (motors, artifacts, etc.) also contributes to the change in their traditional ways.

The pressure caused by the presence of so many prospectors for gold has a serious effect on development projects, on legal systems, resource management systems (agriculture and forestry, extractivisim, etc.) and essential personnel such as doctors, teachers and engineers. Many of the latter abandon their communities either to serve the *garimpeiros* or join the hunt for gold. The spread of infectious diseases such as malaria and tuberculosis and sexual diseases such as syphilis and AIDS, carried by the *garimpeiros*, is causing grave problems throughout the region. These diseases have been especially harmful to the indigenous peoples. Other social consequences involve corruption and insecurity. Several forms of corruption are common in the gold mining areas, among them prostitution and bribery of public officials. The use of drugs and alcohol and the presence of large sums of money have contributed substantially to delinquency.

3.8 Other Inhabitants

Amazonia is home to other types of inhabitants, especially migrants, who deserve mention. Such is the case of the oil exploration workers and the scientists. Oil exploration workers are seasonal and generally come from outside the region. Tens of thousands of workers flocked to the Peruvian Amazon during the oil "boom" of the 1970s. On completion of the work, most workers return to their places of origin. Some, however, stay on in the cities in search of a new life.

Scientists, domestic as well as foreign, are arriving in the Amazon in increasing numbers and currently total in the thousands. Although very few remain in the Amazon, they study the region exhaustively. They also disseminate scientific information about the Amazon at both the national and international level, thereby helping to destroy the myths which have been spawned about the region. Growing international interest in the Amazon has also generated a steady stream of tourists to the region. Ecotourism in the Amazon is expected to have a bright future, although as yet no clear policy has been developed on how this income may benefit the local populations.

Another aspect of the situation that cannot be overlooked is religious proselytism. Starting with the arrival of Europeans, it has increased sharply in recent decades as churches and religious sects have proliferated in the region. Granted that freedom of religion should be respected, proselytism that seeks to induce persons to accept a determined religious belief and to shape the way in which Amazonian peoples use traditional foods and medicines, as well as attempting to alter their organizational structure, should be carefully watched by authorities as well as by the people concerned. Unfortunately, many religious groups attempt to interfere in the life of the indigenous peoples, establishing parallel organizations and inducing the inhabitants to join by providing special health and education services and other benefits.

IV

ENVIRONMENTAL AND SOCIAL PROCESSES AND IMPACTS

4.1 Land and Property in the Amazon

As understood outside the region, ownership of land is a basic human right. In the Amazon, however, from the earliest days land tenure patterns have developed which do not necessarily reflect possession of individual or family plots but rather the usufructuary right of certain areas. The ownership of individual parcels, large or small, often interferes with the ancestral rights of the usufruct of resources.

This usufructuary right to land, generally large extensions of land, is part of the evolution of the oldest inhabitants of the region, principally of the indigenous peoples and the extractivist communities. The use of land is a matter of internal agreement in the community, which assigns some areas for agriculture while reserving others for community use, especially for harvesting, hunting and fishing. Local customs and usages play an important role in the distribution of land. The ownership of land and the value thereof is determined not by its size but by the resources that it produces. As a result, the community does not engage in land speculation. This type of communal property also permits the maintenance of a balance between population and resources, such as rubber and nuts in Brazil, required for community support or for commerce.

The legal systems adopted by the countries, based on Western concepts of individual land ownership, conflict with traditional forms of land use. On the one hand, government offices do not recognize traditional land usage rights as they are not sanctioned under the law. Government offices, therefore, grant communal lands to "natural" or "legal" persons from outside the area for farming, mining, lumbering and tourism on the grounds that the lands are available. At the same time, their intent is to force the traditional communities to comply with individual property laws and distribute the communal lands, thereby creating deep conflicts between indigenous and extractivist peoples and the new owners.

Some basin countries have taken important legal steps in recent years to recognize communal ownership of land for the indigenous and extractivist peoples. They have done so by establishing indigenous territories and "extractive reservations" in Brazil, communal reservations in Peru, indigenous buffer zones in Colombia, and biosphere reservations in Venezuela. The new Colombian constitution approved the concept of collective property, thereby creating interesting possibilities for other population groups. The most common problem involves recognition of areas smaller than those actually in use and the fact that mining, forestry and hydrocarbon concessions often dominate areas in use, creating new conflicts over the exploitation of natural resources.

The colonization process, planned or spontaneous, together with the arrival of migrants, has introduced the new form of parcel ownership to the region. This operates in several ways: through grants by the state; appropriation or invasion, followed by legalization; and the purchase of parcels from third parties.

This new form of land ownership in the Amazon has brought about deep change and created new fields of endeavor, to wit, the buying and selling of land, land speculation, and the squandering of resources. Land as a tradable commodity encourages the appropriation of large areas for purely speculative reasons, especially if the state provides incentives and tax exemptions for investment in the Amazon and surrounding areas. Speculation, in turn, encourages deforestation as the clearing of land is considered an "improvement," thereby enhancing its value.

Squatters take possession of cleared or used land, with the intent of obtaining legal title at a later date. This has resulted in the squandering of forest resources in some countries as settlers have burned trees and cleared lands unsuited for agriculture, especially in the high regions of the Andean countries. It has also produced conflict between the indigenous peoples, extractivists in protected areas and the migrants. The root of the conflict has always been the lack of territorial laws or adequate controls prior to the opening of a highway. Behind the squatters are land speculators skilled in the use of legal loopholes, a lack of official control and the complicity of government officials.

The excessive use and ownership is another characteristic of the Amazon and is caused by the sectorial manner in which land is granted.

Several offices and ministries are responsible for granting land for forestry development, farming, mining, oil exploration, tourism and the like. This has produced confusion and chaos. It generates continual conflict over land ownership among indigenous peoples, extractivists, miners, foresters and others.

In some instances land claims exceed the amount of available land, and more rights are claimed than can possibly be granted. It is essential, therefore, that clear legal procedures be adopted to reconcile land use and ownership rights, especially for the people of the jungle. Equally challenging will be the resolution of problems of communal usufruct rights to resources and the establishment of laws governing land use binding on all concerned.

4.2 The Impact of Farming and Grazing

Much of the Amazon that was settled by colonization is being used for agriculture and ranching. How many hectares are dedicated to these ends is difficult to ascertain; areas vary in size due to the practice of leaving some land fallow to allow forests to regenerate and to create new primary or secondary forests.

Farming in the Amazon consists largely of the production of subsistence crops, principally yucca, corn, rice, beans, bananas and a variety of fruits, either native or introduced from abroad. The main industrial crops are African palm oil, cacoa, chiote, fibers (jute), tea, rubber and coffee, among others.

Grazing and livestock areas do not compare to those of the past. Grazing areas in the Peruvian Amazon, for example, total 207,971 hectares, with a cattle population of 228,090 head.

Agriculture and livestock production are generally extensive. Yields are low, however. Forest resources, which are simply burned in the clearing of land, are badly wasted. The meager contribution of agriculture and livestock production to GDP is disproportionate to the effort involved.

The clearing of the forests to make "improvements" and insure land ownership has expanded the agricultural frontier in a deceptive manner. A high percentage of land is abandoned every year due to rapid exhaustion of soil fertility. Also, official agricultural statistics for the area fail to reflect the reality of the situation due to the lack of periodic livestock surveys in most of the basin countries.

Low yields are due generally to the introduction of technology unsuited to Amazon conditions and to a lack of inputs, which are expensive and hard to obtain. The use of more appropriate systems, such as agroforestry and the planting of permanent heterogeneous crops, is limited by a lack of information based on the experiences of successful farmers and cattlemen. In some cases, such as coffee production in the Upper Peruvian Jungle, the use of agroforestry systems would increase production tenfold. (INADE-APODESA, 1990).

It is interesting to note, too, that the security provided by land ownership does not necessarily relate to the efficient use of resources or to improved production. The key is generally the ability to adequately market the product. This, in turn, is related to prices and the location of nearby markets.

The most worrisome aspect of agriculture and livestock production in the Amazon is the low percentage of land which is put to good use compared to the lands set aside for that purpose. A contributing factor is the high rate at which land is abandoned. Also, some land in Bolivia and Peru is being used to produce coca. In Brazil an estimated five million hectares of first cycle pastureland is deteriorated or unproductive (Serrao, 1990). In Peru, the same amount of land is used for livestock production as for coca cultivation. Low productivity and the small contribution to the GDP of these countries is also a cause for concern. The environmental consequences of settlements geard to farming and ranching are tied to the impact on renewable natural resources, mainly the forests, water and biodiversity.

Clearing of the forests is one of the more palpable results of colonization. Coming from ecologically different regions, settlers view clearing as essential to development of their farms, an attitude fostered by government officials seeking to promote agriculture and ranching as essential activities. The large development projects which have been carried out in several countries with international financing have been based on agriculture, ranching and, later, on lumbering. Environmental factors were not taken into consideration in the execution of projects; the exploitation of wood products was hardly considered and no provisions were made to replace them. Highway construction was a means to link areas for colonization purposes, with scant concern for the agricultural potential or the ecological sensitivities of the regions that they served. The clearing and burning of forests was consciously planned and promoted. From the settler's point of view, clearing and burning is a rational decision. The regenerative ability of much of the Amazon soil is extremely slow, a fact that neither the settlers nor many of the technicians realized. Slash and burn was always practiced by the indigenous peoples. It permitted the regeneration of the forests for long periods of time and restored fertility to the soils (Reis and Margulis, 1990). However, as large numbers of settlers moved into the region and land parcels were small, the clearing of land assumed a special intensity in order to insure ownership—all of this encouraged by government programs anxious to obtain the fiscal incentives and credits needed for agriculture and ranching.

Most Amazon countries, with the exception of Venezuela, initiated their large colonization programs in the 1940s. Deforestation increased at an impressive rate. From 1975 to 1988, Brazil deforested 367,000 square kilometers and continues to deforest at an annual rate of 28,000 square kilometers (INPE, 1990). In Peru, 21,700 square kilometers were deforested between 1975 and 1986, according to government statistics, at an annual rate of 2,800 square kilometers, although total deforestation estimates range from 51,220 to 85,000 square kilometers (Webb and Fernández Baca, 1991). In Colombia, a recent study based on the interpretation of satellite images shows a total deforested area of 2 million hectares and another 2 million in the process of being opened, representing 10 percent of the total area (Etter, 1991). Only estimated data is available for Bolivia and Ecuador. In the entire Amazon region, an estimated 800,000 square kilometers have been deforested, more than 50 percent of that total in Brazil.

Deforestation in the Andean countries is concentrated in the Andean piedmont and on the eastern slopes of the mountains where steep grades and heavy rains cause severe erosion, with catastrophic damage to roads, the soil, towns and human life. Each year produces a high toll in human life, homes destroyed and crop loss. The cost of road maintenance is high, especially during the rainy summer months. The effect of the settlements on the water is everywhere evident, although exact information is scarce. Water contamination is widespread. Not only do the inhabitants build their homes near the rivers and throw their garbage and kitchen and bath waters into the streams, but manufacturing plants—especially the saw mills—do the same with industrial wastes. Rivers carry tons of sediment caused by erosion, filling streambeds with silt. In the heavily deforested areas of the eastern slopes of the Andes, the flooding of rivers, as well as landslides, have become more frequent, inflicting massive damage on crops, the infrastructure and human life. This is a particularly serious problem in the coca-producing areas.

ENVIRONMENTAL EFFECTS OF LIVESTOCK IN THE COLOMBIAN AMAZON

A detailed study prepared in the San José del Guaviare colonization zone of Colombia by the Corporación Araracuara (Dainco-CASAM agreement) shows that the productivity of the livestock holdings is not sustained but diminishes with the passage of time, becoming marginal at the end of 10 years or more. Thus, only the very large (more than 200 hectares) ranches remain profitable. Load capacity tends to decline from 1.4 head per hectare to 0.5 head per hectare in a five to ten year period. The environmental effects of this type of holding, in the "solid land" areas are:

1. Loss of biological diversity. From approximately 500 species of plants per hectare in the forest, the number drops to less than 30 in pastureland.
2. Chemical impoverishment of the soils and diminution of the already low fertility levels.
3. Alteration of the hydric balance of surface and subsoil waters produced by clearing of the forests and direct exposure of the soil to rain and sun as well as by compacting of the soil by animal hooves.
4. The activation of erosive processes, loss of soil and stoppage of the drainage systems by increased runoff of surface water. Soil losses are between 2.5 and 4.3 tons per hectare in pastureland, compared to 0.3 tons per hectare in the forests.
5. Propagation of forest fires (in 1979 a fire of more than 1,000 hectares was recorded).

Source: Andrade and Etter (1987)

The loss of biodiversity is also attributed to the establishment of settlements and the clearing of the forests. Most original forest species have disappeared in farming and ranching areas. Also, hydrobiological resources—and particularly fisheries—have been affected by sedimentation and chemical contamination of the water and by the clearing of trees in forests along the river banks, which are important for the feeding, refuge and reproduction of many species. The loss of biodiversity is especially serious in the upper jungle forests or on the eastern slopes of the Andes, characterized by high diversity and the quantity of endemisms.

The contribution of the Amazon to global environmental problems is based essentially on the generation of CO_2, one of the most important contributors to the greenhouse effect. The burning of one hectare of tropical Amazonian forest generates the emission of an estimated 90.8 to 233 tons of CO_2 per hectare, according to the biomass of the forest (Reis and Margulis, 1990). Thus, a total of between 72 million and 178 million tons of CO_2 would have been generated during the years of deforestation. The clearing of

THE EXPERIENCE OF MANY AMAZON SETTLERS

There is a common denominator in the experience of most settlers who receive land under government colonization programs in the Amazon. They are first attracted by government publicity seeking to encourage settlement of rural communities in the Amazon. They are told that the land is fertile; that the program will provide 30 or more hectares of land, and that technical assistance and credit will be made available. They often arrive in the Amazon accompanied by a wife and several small children and with neither money nor family goods. Untrained, almost illiterate, their documents in disarray, they settle on the land provided by the colonization and agrarian reform agency—the INCRA, for example, in Brazil. They are awarded a certificate of possession which, they are told, is redeemable for a property deed when they show that they are actively working the land. The land they have been assigned has been carved from the jungle and is located beside a path hardly wide enough to accomodate a cart. Naturally, the settler-turned-farmer builds his first hut close to the path. There is no water at the site, however, so the family is obliged to bring water from afar, until they can build a well. If the weather is good, the farmer digs a shallow pit, cuts trees and burns them; if the weather is bad, he must wait. In either case, the new arrival will look for temporary work—with another settler who has been there for a longer time, or on a large estate, or perhaps in the town. Alone, or with a friend, he begins to carve out the first hectare of his land in order to plant his crop of rice, corn and beans. He hurries, as his meager funds will not support his family for long without a harvest. After cutting the trees and planting the crop, in the scant free time available between weeding and other farm chores, he will construct a small house of planks with a palm thatch floor and roof.

Several things may have happened by now, none of them auguring well for a person who, such as he, arrived with only the clothes on his back. He will have learned that the school and the health clinic, which should be open and operating several kilometers from his property, have not opened or have been closed by teachers and nurses angry and frustrated over nonpayment of months of back wages. That his children cannot go to school is bad enough, but the entire family is sick—or at least anemic and suffering from intestinal parasites. It is almost certain, too, that he and some of the family may have contracted malaria, greatly reducing their ability to work. The farmer can consider himself extremely lucky, meanwhile, if no family member has suffered an accident felling trees. On top of this, the first crop probably turned out poorly for a series of reasons: it was planted late, or the farmer was too busy with other work or had no help. If things manage to go smoothly, however, the farmer can harvest enough to support himself and his family, with possibly a bit left over to sell, and thus prepare for the second crop. But selling is not easy. The road to the marketing center is bad and freight costs are high; the vendors are abusive and—of course—the government warehousing system is not operational. If he manages to surmount these obstacles, the farmer will buy provisions and return home to repeat the cycle. Regardless, it is more than likely that this new settler will never be able to save enough money to plant permanent crops, which are expensive and do not yield anything for many years. Also, he will quickly discover that coffee and cacao prices, as well as the price of rubber and other crops recommended by the technicians, are so low that it hardly seems worth the trouble to harvest the crop. The technicians, if they even visit his farm, will paint a rosy picture of agroforestry and of a model farm dotted with mahogany trees. The farmer may try to create such a farm, lugging seedlings from the forest to do so. But even then he will have to wait 20 to 30 years before he can sell the wood. While this is happening, the soil is losing its fertility and the farmer is waging a never-ceasing battle against weeds and plant diseases that increase year-by-year. In all probability, he will never escape the vicious circle of planting merely to survive in his search for a better life. He must continue, meanwhile, to clear land to maintain his rice, corn and bean production. His wife has gone to the town with the children to find a school. To earn loose change, he will continue to work for others, for a pittance. His malaria will only get worse.

One fine day, he sells his land to a neighbor who has come to the Amazon with money or has had a streak of luck. The sale is illegal. At that point, the farmer may discover a new business: registering at new settlements for the purpose of quickly reselling the land. It is more likely, however, that he will decide to try his luck as a *garimpo*—and abandon his family. He may also go into the forest, into the nearby indigenous territory to farm illegally, without permission. Through it all, only one thing is certain: until he dies, our farmer will be trapped in a vicious cycle marked by two phenomena, miserable lives and a lot of destroyed forestland.

Source: Study of abandoned parcels in the POLONOROESTE settlements in Rondonia, Brazil.

approximately 36,000 square kilometers per year of Amazon forest (Brazil 21,300 and the other countries some 15,000 square kilometers) would therefore generate between 326 and 800 million tons of CO_2. A truer value for Brazil might be 300 million tons a year (Victoria et al., 1991)

The social consequences of colonization relate to the settlers themselves and to the indigenous peoples that occupy, or occupied, their territories in the colonized areas. Relocated settlers, whether organized or spontaneous, are numerous, originating almost exclusively in the peripheral zones of the Andes and in the northeastern and southern regions of Brazil.

The construction of the Brasilia-Belém Highway in Brazil attracted an estimated 350,000 migrants; 13,000 families were settled along the Transamazonian Highway, and 60,000 property titles were given out in the Araguaia-Tocantins region (Reis and Margulis, 1990). A similar program was carried out along the Cuibá-Porto Velho highway, in Rondonia, in the 1980s. It is extremely difficult to determine with any accuracy the number of migrants who have settled in the Brazilian Amazon following construction of the highways and the colonization program. The situation is similar in other basin countries. In the case of Peru, internal migration data starting in 1976 has recently become available, indicating that 268,316 persons migrated to the Peruvian Amazon from the coastal and Andean zones in 1976-81 (Webb and Fernández Baca, 1991).

The migrating settlers have faced a variety of social problems: adaptation to the environmental conditions of the Amazon; partial or total failure of the colonization programs, and distortions caused by illegal crops and other activities like gold prospecting. Most of the settlers were from peripheral Amazon areas and did not know the type of life that awaited them in a very different environment. They were forced to adapt to vastly different climatic conditions and new diseases. For migrants from cold Andean climes, the change to a tropical zone has been dramatic. They have had to alter their dress, their hygiene and their way of building homes. New diseases like malaria, as well as skin infections and intestinal parasites, have caused continuous epidemics in several colonization zones.

The process of adapting to new crops and herds and the manner of raising them have been equally difficult. Government-instituted training programs were only partially effective due to the massive and spontaneous influx of migrants, or were suspended when foreign credits dried up (Bedoya et al., 1985).

The total or partial failure of the development projects caused severe social problems involving particularly the social services of health, education, housing and communications. In many instances, these services began to collapse under the sheer number of settlers, the lack of continuity in state support and the termination or suspension of external financing. There are instances of excellent services at the outset, as in the Huallaga Valley of Peru, later halted for lack of state financing. The settlers and their dependents often had to face the almost total suspension of basic social services after several years of operation. In other cases, the settlers faced problems arising after the initiation of programs, such as the *garimpo* phenomenon in Brazil and coca production and narcotrafficking in Peru and Bolivia. The massive cultivation of coca in some areas and the illegal production of cocaine in Peru and Bolivia have created grave problems of insecurity, corruption and violation of human rights, among other things. The most serious recorded case is that of the Huallaga Valley in Peru where terrorism, guerrilla activity and narcotrafficking have destabilized long-term colonization programs (APEP, 1990; García-Sayan, 1990) and have created frightening environmental problems (Dourojeanni, 1990).

ARCHAEOLOGY EXPLODES ANOTHER OF THE OLD MYTHS ABOUT THE AMAZON (THE OLDEST EXAMPLE OF CERAMICS IN THE AMERICAS, FOUND IN AMAZONIA)

Amazonia not only has a long history of human settlements but may well be one of the oldest settlements in the Americas. This deduction stems from the latest discovery made in Santarem by an international team of archaeologists who found shards of ceramics seven to eight thousand years old—predating what had until recently been considered to be the oldest example of ceramics in the Americas. For purposes of comparison, the oldest specimen in the world was found in Japan, dating from 11,000 years ago.

According to Anna C. Roosevelt at Chicago's Field Museum, this find sheds light on events in the history of human adaptation to the tropics, particularly to the alluvial plains of the major rivers in the basin. It also raises a number of questions and triggers a radical change in the general thinking about cultural development in the Amazon, which until recently held that the extreme poverty of its soils had limited cultural development of the region, making Amazonia the least likely place to look for the oldest example of ceramics in the hemisphere. The facts, however, have changed those views. Amazonian settlements, then, would not only appear to have had a very long history in the area, but the inhabitants did not necessarily migrate from other places, such as the Andes, to the basin. Furthermore, the region was seemingly sufficiently rich in resources to have been the site of this cultural development. Roosevelt says: "We are beginning to see that many of our ideas about Amazonia were simply wrong." So it is not impossible that the Amazon of prehistoric times—like the Nile or the Ganges—could well have supported large human settlements. Its impact on the human cultures of the sweeping European invasion could thus have been even greater than we thought. At the same time, the huge biodiversity of the Amazon region is not entirely the result of the lack of human interference, as we have seen recently, but is partly the result of the interrelationship of nature and culture.

Source: John N. Wilford, *New York Times*, Dec. 13, 1991

The settlements have had an important social impact on the indigenous peoples located in the zones selected for development projects. Prior to the 1970s, the Indian was simply not taken into consideration and was stripped of his land, forcing him to move further into the jungle. The Indians' position began to strengthen in the 1970s and the tribes were able to win certain land ownership rights. These rights were usually marginal, however—insufficient to enable them to preserve their culture and exercise the right to the resources of their former tribal homelands. Entire indigenous tribes have disappeared; others have been forced to emigrate to new areas beset with grave problems; still others have integrated with the settlers and have forfeited their culture. In each instance, they have had to face problems of health, cultural aggression, violation of their human rights and usurpation of their territories, or at least a large part thereof.

Finally, the total or partial failure of the settlements has created further social problems as settlers migrated back to their places of origin, to cities in Amazonia, and to new areas in search of land. The large settlement programs of Brazil have resulted in a flow of settlers unable to adapt to their new surroundings back to their places of origin (Reis and Margulis, 1990). Similar return migrations occurred in certain areas of the Andean countries, occasioned by problems of safety, narcotrafficking and guerrilla activity, although precise numbers are hard to ascertain. With the partial or total collapse of the settlements, some of the colonists emigrated to the cities of the region, further exacerbating slum conditions in the urban centers. The population of the larger of the cities located in Peru's Amazonian settlement area has expanded spectacularly since 1941: Pucallpa, 52 times; Tarapoto, nine times; and Tingo María, 52 times (Webb and Fernández Baca, 1991). Many settlers, faced with impoverishment of the soils, have continued to migrate spontaneously in search of new land—only to perpetuate the cycle of deforestation, clearing, burning, planting, and then abandoning the land.

The economic consequences of the settlement programs can be viewed from three perspectives: that of the settler, and from both a national and an international point-of-view. As viewed by the settler, agricultural and forestry production failed to produce a sufficient return, further adding to their already-considerable economic burdens. The poverty of the soil, the lack of adequate technologies, transportation costs and national and international prices—all, in the end, asphyxiated the settlers, creating a subsistence economy unable to exert much of an impact on the national or the regional economy. Entire valleys throughout the region, where the initial development prognosis was optimistic, have simply become new pockets of poverty, fraught with social problems. The dizzying increase in areas dedicated to coca cultivation in the high Amazonian regions of Peru and Bolivia is due in large measure to the meager return provided by legal crops. Factors inducing settlers to grow coca include the low yield of legal crops, the rapid loss of fertility of the soil, depressed commodity prices (for coffee, cacao, rice, meat and the like) and the deterioration of the means of communications. Coca production, on the other hand, yields healthy profits; the drugs can be manufactured *in situ*, are easy to transport and have a high international demand (Morales, 1989; APEP, 1990; García Sayan, 1990). In contrast, in areas where top-quality technology is employed and the production cycle—from planting to export of the final product—is complete, settlers have achieved considerable success. Such cases, which often go unnoticed, deserve detailed analysis and can provide helpful lessons for the future (INADE-APODESA, 1990).

The economic consequences of settlements at the country level vary, but two of them are particularly salient: they failed to achieve the desired result, and they helped to increase the external debt. The economic contribution of the major development poles that should have generated investment projects for the countries is very modest when compared with the amounts originally forecast. The gap between the amount invested and the benefits obtained is also very large.

In the case of Brazil, investments in roads and other infrastructure for the settlements, together with incentives for production, have been partly responsible for a sizable external debt that should have been covered by the resulting development. The cost of settling each family along the Transamazonian highway has been estimated at US$39,000 (Reis and Margulis, 1990). After the substantial investments made there, the northern region accounts for 5.7 percent of Brazil's population, but its contribution to GDP is only 3.1 percent.

In the case of Peru, large-scale settlements have done little to solve the nation's economic problems. The establishment of cattle ranches to supply the country with meat was a priority objective of the settlements program. After 40 years of enormous investments, the results have been mediocre at best. The 228,000 head of cattle produce some 9,000 metric tons of meat a year—far less than the 31,000 MT of fish consumed by the region in 1990, while the country continues to import beef. Cattle production in the Peruvian Amazon, furthermore, represents only 5.7

percent of the nation's total (Webb and Fernández Baca, 1991). A similar situation obtains with other legal crops, which have failed either because of a lack of appropriate technologies or because of transportation costs and international competition from less expensive commodities, such as rice and palm oil. However, the most profitable Amazon crop, albeit an illegal one, is coca, which contributes the greatest amount to the balance of payments—between $800 million and $1.2 billion a year.

The large-scale colonization of the Amazon by the different countries may be generally said to have been unprofitable, and to have created more problems than it solved. The main international consequence of the settlements has been the failure to cover the cost of the loans granted, at least with the proceeds of development generated thereby. One of the economic problems engendered affects the countries, which are unable to repay the loans, and the financing agencies, which cannot collect. The extent to which the Amazon settlements have contributed to the countries' external debt is a subject that warrants serious study.

The settlements have also had political consequences, consisting mainly of the premature termination of scheduled projects and the creation of problems of domestic law and order; and, on the positive side, the growing conviction of the decision-makers that the Amazonian development model should be revised.

The mass migration that accompanied the opening of new roads disrupted the orderly planning of many settlements. The influx of squatters in many cases was so heavy that initial plans collapsed; land unfit for agriculture was occupied, and areas earmarked for forestry management and reserves were invaded. Plans had called for the establishment of 50,000 hectares of rice plantations on level and fertile ground in the valley of the Mayo River, for instance, but the wave of squatters destroyed another 130,000 hectares of forest on hillsides and nonarable land. Similar events have transpired in other settlements.

The opening up of large areas, newly accessible by road, or the failure of projects gave rise to alternative activities, such as the cultivation of coca and prospecting for gold, which created internal havoc with widespread political repercussions that were difficult to control. The production of coca leaves and drug trafficking created extremely serious domestic problems for Bolivia, Peru and Colombia. These problems have since extended beyond the borders of those countries and the region.

At the same time, the partial success or the failure of the colonization projects and the problems they created had an impact on the countries' approach to the development of the Amazon. The policy repercussions took a bit longer. Numerous environmental, social and political studies are now promoting the search for new alternatives which have aroused the interest of decision-makers, in some countries more than in others. Information now available will allow for an objective reevaluation of Amazon development planning.

4.3 The Impact of Forestry

The Amazon has a wide variety of forestry species, estimated at some 4,000, but a relatively poor commercial performance, since only about 50 species are exported. Forest extraction amounts to a maximum of 50 cubic meters of wood per hectare, ranging in most cases between 5 and 20 cubic meters. In some areas quite close to important domestic consumption centers—the high-Andean forests, for example—as many as 126 species are used (Brack, 1988), but only five are marketed by name. The others are sold as common lumber.

A substantial percentage of the commercially marketed wood is obtained by purchasing trees from woodlands earmarked for agricultural use. Practically none of these areas have been scheduled for permanent forestry management. Extraction is selective, limited to a few species that have a commercial value and are known in the national and international markets. The countries in the basin have forestry legislation that establishes a system of concessions or harvests, and in some cases requires permanent management with plans and replenishment of the resource. The generalized disorderly land tenure and the impossibility of taking advantage of the vast array of forestry species, however, have made permanent management systems virtually impracticable. Whenever access roads to the forests are built, squatters invade the planted areas to take possession of the land for farming and cattle raising. Most of the species are not commercial, either because their qualities are not known or because of their low prices, which means that only the more valuable species are profitable.

Clearing for the production of charcoal for domestic and industrial use is also important, particularly in Carajás. It is estimated that the average steel plant consumes 260,000 tons of wood annually, equivalent to 3,250 hectares of forest. This system of selective extraction alongside access roads and navigable rivers has led to systematic depletion of certain valuable species. It is very difficult to estimate the acreage of the forests that have been systematically felled. The major lumber industry centers have found it increasingly difficult to obtain tropical hardwoods, particularly because of the dwindling amounts available from traditional suppliers in Asia and Africa. The mounting pressure on Amazonian woodlands is dangerous, for if these ill-advised practices continue, destruction of the forests will accelerate.

Integral use of the forests, considering the entire range of forestry products other than lumber, is neither organized nor technically efficient. While the forest extractivists secure certain types of wood, the residents make use of the wildlife and various other products. Timbering usually interferes with the interests of local inhabitants, who see a decline in the supplies of their traditional resources in the form of food, medicinal plants, and other products. Orderly and technically proper use of biological diversity continues to be a problem.

The challenge of establishing systematic, permanent, technical, and integral use of the Amazon forests is enormous and implies considerable future responsibility for the countries of the basin. Technologies must perforce be developed for appropriate, integral, and sustained use of these woodlands. In some instances, new methods are being tested, such as the management system that features alternate strip felling in Peru's Palcazú valley (INADE-APODESA-AID, 1990), where all of the species are being extracted and natural regrowth is under way.

Given the vast stretches of existing secondary forests resulting from the abandonment of unproductive land, research should be conducted on possible integrated uses for these areas. Certain studies (Denevan and Padoch, 1990) attest to the viability of secondary forest management and their ability to produce rapidly growing trees plus secondary products such as honey, medicinal plants, wildlife, etc. High priority should be assigned to the management of these forests. If the present widespread and disorderly exploitation of this asset continues unabated, the region's forestry resources risk total pillaging and the most valuable species may become commercially extinct.

In view of the disappointing results of farming and ranching in the region, it is particularly urgent to examine the available agroforestry systems. Some of the experience in this field can be useful, such as the various native approaches (Denevan and Padoch, 1990) and modern techniques combining permanent crops with agroforestry (INADE-APODESA, 1990).

4.4 The Impact of Mining and Oil Production

There are two types of mining in Amazonia: large-scale and small-scale. The first comprises exploitation of mineral resources and hydrocarbons (petroleum and gas), while the second includes prospecting for gold and exploitation of precious and semiprecious stones.

The techniques used by the *garimpeiros* (gold prospectors) have an alarming effect on the environment: pollution of rivers by mercury and oil sediment, among other products; destruction of watersheds and farmland; deforestation, hunting and fishing, and invasion of tribal territories (Dourojeanni and Jorge Padua, 1991). In Colombia, announcement of the discovery of important gold deposits in the Naquen mountains (Guainia) sparked a rush of miners to that site. A similar event took place at the Taraira river, also in Colombia, at the border with Brazil. The rivers are heavily polluted with sediment. To obtain two grams of gold requires the removal of one cubic meter of sediment, and in Brazil alone, this means a silt load of 50 million cubic meters annually. Other adverse impacts include muddying of the waters, changes in the hydrobiological resources, alteration of the river beds, impediments to navigation, and a decline in water quality.

Mercury pollution is another critical problem. Mercury is essential to separate and amalgamate the fine gold particles after centrifuging. When the mercury is heated it vaporizes, leaving a pure gold remainder. But 1.32 kilograms of mercury are needed to produce each kilo of gold, which means that many tons of toxic mercury are dumped into the rivers in Amazonia. Mercury vapors from the separation process are injurious to humans unless the necessary precautions are taken, and to the fish-eating population through the waterborne trophic chains. Very simple technologies exist to recover the vaporized mercury and prevent direct contact with those vapors, but unfortunately they are not generally applied.

Pollution from oil in the machines utilized (motors, caterpillar tractors, dredging and other equipment) is also extensive. The 6,000 to 7,000 dredges operating in the area of the Madeira River dump some five million liters a year into that body alone, affecting the nutrient cycle of its waters. The gold panners add to the pollution by using chemicals (sodium cyanide, detergents, and the like), in addition to the organic and inorganic waste dumped directly into the rivers.

The destruction of watersheds and loss of arable soils is another effect. In some areas, the flow of water is completely destroyed, due to the use of dredges that excavate not only the riverbed but the sedimentation on the banks. Since the best farmland in Amazonia is the alluvial and muddy type along the rivers, sizable losses can result in places where gold panning is extensive. The destruction of all plant cover on the banks of the rivers has a direct impact on the reproduction and feeding of fish and other aquatic species. The deforestation, extraction of timber, and hunting and fishing by the gold prospectors are also a source of concern. Nevertheless, roads are being constructed, towns are being established, and airports are being built. Timbering, fishing and hunting are also important sources of supplies needed by the workers.

The problem of the gold prospectors is in some respects very similar to that of cocaine production and trafficking, and there is even some evidence of a connection between the two—particularly the illegal trade in gold and cocaine. Federal and state governments in Brazil have now taken steps to control and regulate gold extraction activities. They include the establishment of *garimpeiro* reserves; a dialogue between the government and the parties involved; better official prices for gold; technical assistance; registration; the monitoring of environmental impacts, such as the *garimpo* control program; global studies of the phenomenon; police and military action; and sanitation assistance. The magnitude of the phenomenon, however, makes it difficult to execute all these measures. In the future, regulation of mining activities and the use of clean technologies should be an important concern of the countries in the basin. The mere conduct of environmental impact studies in every instance should not obviate the need for planning to prevent mistakes. Restoration of the areas devastated by mining for gold and other minerals and by petroleum production should also be a priority.

Major mining activity in Amazonia is still relatively limited, but could become very important in the future. At present, the chief products mined in the region are coal, bauxite (aluminum), iron, manganese, kaolin, and zinc. In Brazil, bauxite is extracted at the Trombetas River, Belém, and there are aluminum refineries at São Luis de Maranhão and Barcarena (Neto, 1990). One of the most important mining centers is Carajás, which has become an extremely expensive project with sophisticated equipment for the treatment of iron and other minerals (Almeida, 1986; Salati et al., 1990). The extraction of iron ore at Carajás was designed in conjunction with important projects for the development of infrastructure to transport and exploit other minerals. It was the source of widespread controversy because of its environmental impacts and the influence exerted on it by the global

THE BALBINA PROJECT: FACTS AND FIGURES

The Need to Ask Why

The gates of the completed Balbina hydroelectric plant were sealed in October 1987, thereby damming the Uatumá River and creating a giant lake in the heart of the Brazilian Amazon.

- According to official data, the cost of these works was US$750 million, not including the cost of 170 kilometers of transmission lines.
- The five turbines (50 megawatts) cost US$3,000 per kilowatt, double the ceiling amount allowed the electric sector for other projects in Brazil.
- The maximum amount of power generated will be 32 percent of the installed capacity (80 megawatts).
- The cost per megawatt/hour is US$108, four times the amount considered to be reasonably competitive and double the estimate for thermal plants. Unofficial figures estimate the cost of Balbina at one billion dollars.
- Balbina will produce 25 times less power per square mile than the Tucuruí dam and 35 times less than Itaipú.
- Balbina will flood 236,000 hectares of tropical forests with 248 cubic meters of timber per hectare. Almost 58.5 million cubic meters of wood were lost, and at least 39 to 51 cubic meters of sawtimber, i.e., a total of 9.2 to 12 million cubic meters. The value is estimated at US$138 to 180 million for the sawtimber and US$400 million for the total amount.
- The decay of forest biomass has turned the water fetid, acid, and low in oxygen content.
- In a wildlife rescue operation, the following 280,000 animals were inventoried: 40,000 sloths, 9,700 armadillos, 9,300 porcupines, 3,700 ant bears, 22,000 monkeys, 48,600 turtles, and 20,900 iguanas. This list represents only a small percentage of those which died, since the number of animals caught was only a tenth of the number captured at Tucuruí. In any case, most of the resaved animals fail to survive the irreparable loss of their habitat.

Balbina has killed the Uatumá River. Downstream from the hydroelectric plant, the population sank into dire poverty. Upstream from the dam, a third of the remaining indigenous Waimiri Atroari were driven out by the flooding of two of their largest towns. A campaign of public disinformation and propaganda was launched at Balbina, misquoting the electric power generation figures and brandishing such slogans as "Anyone who is against Balbina is against his own interests"; "He who defends Balbina defends life"; and "Balbina is Life."

Source: Gribel, 1990.

HYDROELECTRIC DEVELOPMENT OF JAMES BAY
The Balbina of the North?

At the same time questions are being asked about hydroelectric development of the Amazon basin and tropical countries are displaying genuine interest in accepting the challenge of forest conservation, it is obvious that, contrary to what one might think, environmental impact on vast woodland areas and biodiversity is not limited to the less-developed countries.

Hydroelectric development of James Bay in Quebec is being questioned in light of the concerns that triggered the scandal at Balbina. The project comprises a series of new electric power plants that complement three dams situated on the La Grande River. The development represents an increase of 1,000 megawatts over a 20-year period in the electric power which Quebec sells to the New England states and New York City. The new plan would allow all of the water from the rivers that empty into James Bay, on the Quebec side, to be used to generate electricity. This would spark tremendous environmental changes, especially in the hydrological system and in the timing of natural floods and the salinity downstream from the dams. Thousands of square kilometers in one of the most important wilderness areas of eastern North America would be affected. The natural habitat of such vulnerable species as polar bears and caribou would be altered, and a population of fresh water seals that is unique in the world would be endangered. The anticipated effects resulting from this project include destruction of the habitat of millions of migratory birds and pollution of the rivers by mercury, which would affect fisheries downstream from the project site. All of these risks would be assumed at a time when the environmental impact of the first stage of the project is only beginning to be understood by scientists. A source of particular concern is an incident that occurred in 1985, when 10,000 caribou were trapped in the waters of the reservoir on their migratory route and drowned. Also affected is the territory occupied by the Crees, an Indian tribe that has not been given due consideration throughout the process. This is why some environmentalists have not hesitated to call James Bay "the greatest ecological and social disaster" in the northern hemisphere.

While some of the parties to the project have presented environmental impact studies, no study has actually been made of the Cumulative Environmental Impact that would be triggered by the project as a whole. Since this type of study is not required by Canadian law, it is argued that the project does not meet the same environmental standards that apply in the United States.

A number of environmental organizations have asked their supporters for public rejection of the project because of the shared responsibility of Hydro-Quebec and the New York City administrative authorities. In a world that is constantly becoming smaller and more interdependent, it will clearly be difficult to expect that there will be no more Balbinas in the South unless a satisfactory response is forthcoming to the environmental questions posed by some of the projects planned and executed in the North.

strategies of transnational companies (Neto, 1990). Other minerals include manganese, found in the Serra do Navio (Amapá) and in Pará, kaolin in Jari (Amapá), and zinc in the states of Amazonas and Rondonia. Metals such as gold, silver, copper, lead, zinc and less important ones are being mined in each of the other countries of the basin, except Venezuela (Dourojeanni, 1990).

Hydrocarbon production is increasingly important in the region, and its environmental impact may well increase considerably. Some of the countries, like Peru and Brazil, have recently enacted laws to control environmental impacts in mining areas. Their enforcement is limited, however, so the impact on bodies of water, natural resources, and tribal peoples is still severe. The most flagrant case occurred in eastern Ecuador, where the dumping of salt-laden formation water and accidental spillage, plus new highway construction, are producing serious damage to the environment, to the Indian tribes (Tetetes, Sionas-Secoyas, Cofanes, Huaoranis, etc.) and the protected areas, which are being destroyed by the invasion of migrant settlers along the roadways (Kimerling, 1991). Exploration for oil in the Colombian Amazon has intensified in the last few years, and the resulting environmental impact threatens to extend to some of the conservancy areas, which as yet have little protection but are among the most important in the region (the La Paya National Park, Tinigua, and Los Picachos).

Here again, problems are sparked by outside interests and the technologies utilized. The political priority assigned to these activities is often so high that the well-founded claims of the tribal peoples and the environmentalists are ignored.

4.5 The Impact of Energy Use

Energy is, and will continue to be, one of the most important resources for the development of Amazonia, and increasing stretches of land will be used for its production in the future. The alternative sources in the region consist of hydroelectric power, fossil fuels, nuclear energy, and nonconventional sources, such as solar energy and biomass.

The largest reserves of hydro power are found on the peripheral mountain slopes, particularly in the eastern Andes where the difference in elevation and availability of water resources are favorable. The rugged terrain and high risk of erosion will acquire great importance in the future, and the Andean countries will be well equipped to meet their own needs.

The low-lying portions of Amazonia also have substantial hydro reserves: 45 percent of the country's supply is located there and a program for the construction of gigantic dams for energy purposes has recently been launched. Because of the region's level topography, the dams cover vast areas. The Tucuruí project on the Tocantins River, for example, has flooded 2,360 square kilometers of forests to produce 4,000 MW. The Balbina dam, near Manaus on the Uatumá River, will flood 2,000 square kilometers to produce 250 MW (Salati et al., 1990). Other plants are either under construction or on the drawing board to produce 10,000 MW in the Brazilian Amazon.

In general, there is thought to be a great variation in the type and magnitude of environmental impacts of dams. These impacts were reviewed recently by Vaux and Goldman (1991):

1. Direct impacts: Displacement of human populations; deterioration in communications networks; loss of farmlands and destruction of archaeological sites; loss of wildlife habitat and extinction of species; an increase in waterborne diseases; a decrease in the quality of water; excessive growth of macrophytes; sedimentation, a decrease in the number of fish caught downstream from the dams, and alteration of coastal ecosystems.

2. Indirect impacts: immigration; integration of the region into the national economy, with changes in economic and market structures; changes in income distribution and impoverishment of sectors of the population; changes in local natural-resource markets, particularly for fish, and an increase in conflicts between local populations and immigrants.

The Brokopondo (Suriname) and Balbina (Brazil) dams constitute the worst known cases of environmental impact and those in Guri (Venezuela) and Tucuruí (Brazil) feature the best environmental conditions.

The use of nuclear energy to generate electricity is one of the concrete possibilities, but a target for severe criticism worldwide. Its introduction in the Amazon would trigger even greater polemics, especially in view of the possibility of accidents.

Some of the most important cities in the region are largely dependent on thermal, and to a lesser extent, hydro power. The Amazon populations in the Andean countries, especially those in the foothills, make very little use of hydro energy, a field that has been neglected in the large colonization projects. Further, timbering in the high Andean watershed is eroding future hydroelectric potential. Even here, family and local use of hydro power is an excellent way to save on oil consumption. Very little headway has been made to that end because priority usually goes to the large generating plants to supply needs outside the region or the major urban centers.

Brazil has also made a certain amount of progress in producing alcohol as a substitute for oil imports, and in utilizing biomass energy for the Carajás project. Such experience is undoubtedly useful and will be helpful for decision-making purposes. The possibility of reforesting degraded areas to produce charcoal could provide an interesting link between mining projects and the need for jobs in impoverished rural areas.

Rural populations in the Amazon use firewood to heat their homes and cook their food. Very substantial amounts are consumed, and it is the cheapest fuel available for these purposes.

4.6 The Situation of the Protected Areas

The countries of the Amazon region have made unprecedented efforts to set up a system of protected areas or conservation units. The Amazon system for such conservancy unquestionably features one of the best designs achieved thus far in the world. The flip side, unfortunately, is that the system is ineptly administered and managed due to the shortage of funding over the past decade. It can nevertheless still be salvaged. The earmarking of sites for the protection of biodiversity, research, promotion of tourism and sustainable management of natural resources is increasingly prevalent in land use in the Amazon region. The categories of protected areas vary from one country to the next, and they may be known as parks, national or state sanctuaries or preserves, communal or ecological reserves, etc. New concepts have emerged in recent years about areas that can ensure a supply of natural resources for indigenous peoples (communal reserves, Indian reservations, etc.) and for other inhabitants, such as the extractivist reserves in Brazil. The earmarking of areas for tourism is another new form of indirect use of resources which at the same time promotes culture and a knowledge of the region's ecosystems.

Although technically well designed, the establishment of protected areas for ecological purposes—in other words, the protection of ecosystems, species, and germ plasm—has been carried out with little or no participation by the local or neighboring populations. The ensuing conflicts very often threaten the permanence of such areas. The most recent concepts are predicated on the need to ensure that the peoples in these territories are given integral and permanent use of the resources for extractive purposes. This possibility, to which the inhabitants of the forest assign high priority, is also of great interest for sustainable management of broad areas where attainment of various environmental protection objectives and direct economic production for the benefit of those peoples are feasible. The beneficiaries will in turn protect those resources, thereby requiring less financing from the state. Since the population centers in the region derive a substantial portion of their food from hunting, fishing, and forest products, any consideration given the establishment of extractive areas for future use close to those settlements, in order to ensure a sustained flow of such resources, is highly advisable.

A major effort has been made to classify protected areas in the Amazon (Table 7, Map 4). As noted earlier, however, this has generally progressed no further than the initial stage and there has been no land use management, which obviously requires funding. Most of the protected areas in Brazil, for example, have been established since 1980. They comprise 97,062 square kilometers of national parks; 29,830 square kilometers of biological reserves; 26,926 square kilometers of ecological stations; 11,302 square kilometers of ecological reserves; 14,566 square kilometers of protected areas; 122,497 square kilometers of national forests; 21,630 square kilometers of extractive reserves, and 837,684 square kilometers of indigenous areas (Reis and Margulis, 1990). The recently established Kayapó and Yanomami Indigenous Parks constitute a major addition to managed lands in the region. The protected areas have also suffered the effects of outside mining, forestry and colonization interests, and many of them have been cut back or simply invaded. Such is the case of the Cuyabena Wildlife Breeding Reserve and Yasuni National Park in Ecuador (Kimberling, 1991) and the recently reconfigured La Macarena Reserve on the northern border of the Colombian Amazon (INDERENA, 1990).

TABLE 7: SIZE OF PROTECTED AREAS IN THE AMAZON BY COUNTRY

Country and Type of Protected Area	Approx. Size (hectares)
BOLIVIA	**4,338,000**
National parks	1,954,000
Biological stations	135,000
National nature reserves	2,159,000
Wildlife refuges	90,000
BRAZIL*	**116,150,140**
National parks	9,706,200
Biological reserves	2,983,000
Ecological stations	2,692,600
Ecological reserves	1,130,200
Protected areas	1,456,600
National forests	12,249,700
Extractive reserves	2,163,000
Indigenous areas	83,768,840
**COLOMBIA ** **	**24,217,703**
National nature parks	3,810,000
National nature reserves	1,900,000
Indigenous areas	18,507,703
ECUADOR	**2,248,426**
National parks	1,085,000
Ecological reserves	403,000
Biological reserves	4,600
Wildlife breeding reserves	655,781
Protected forests	100,045
PERU	**15,110,378**
National parks	1,949,826
National reserves	2,080,000
National sanctuaries	131,609
Historic sanctuaries	32,592
Reserved zones	3,405,242
Protected forests	387,818
National forests	3,266,244
Communal reserves	34,745
Indigenous territories	3,822,302
SURINAME	**574,000**
Natural reserves	574,000
VENEZUELA	**18,613,000**
National parks	5,476,500
Natural monuments	3,050,000
Forest reserves	1,215,000
Biosphere reserve	8,871,500

* Data on Brazil updated to November 1991 (does not include the new Yanomami and Kayapó territories.)

** Includes protected areas of tropical jungle situated on the periphery of the Amazon basin.

A recent study of the system of protected areas in the Colombian Amazon region (Rojas and Castaño, 1991) shows that, while they are highly representative ecologically, they are not very well consolidated. More than half the parks have no staff assigned to them, including one created in 1977 (Los Picachos). In all, a staff of 28 has been assigned to cover an area of nearly five million hectares (one person for every 15,000 square kilometers). Another five parks are seriously threatened by development projects, such as the marginal jungle highway, oil drilling projects, squatter settlements, or preplanned colonization.

The need for a system of well-managed protected areas in the region is a high priority, for Amazonia contains a biodiversity with ecosystems, species and germ plasm that are unique in the world. Here the common interests of tribal peoples and environmentalists might lead to highly constructive and viable solutions in the future.

4.7 Quality of Life and Poverty in the Amazon

The quality of life is a concept central to sustainable development. It means more than just a private standard of living, and covers a number of variables bearing on subsistence needs, shelter, affection, understanding, involvement, leisure time, creativeness, identity, and freedom, many of which cannot be measured. In general, the "living standard" measurement has been keyed to concepts of growth and economic development, with the notion of how much a person owns being the primary factor. The quality of life concept refers to both the living standard, or how much one "has," and to the notion of "being" — the appropriate balance of "having in order to be" (IDB/UNDP, 1990).

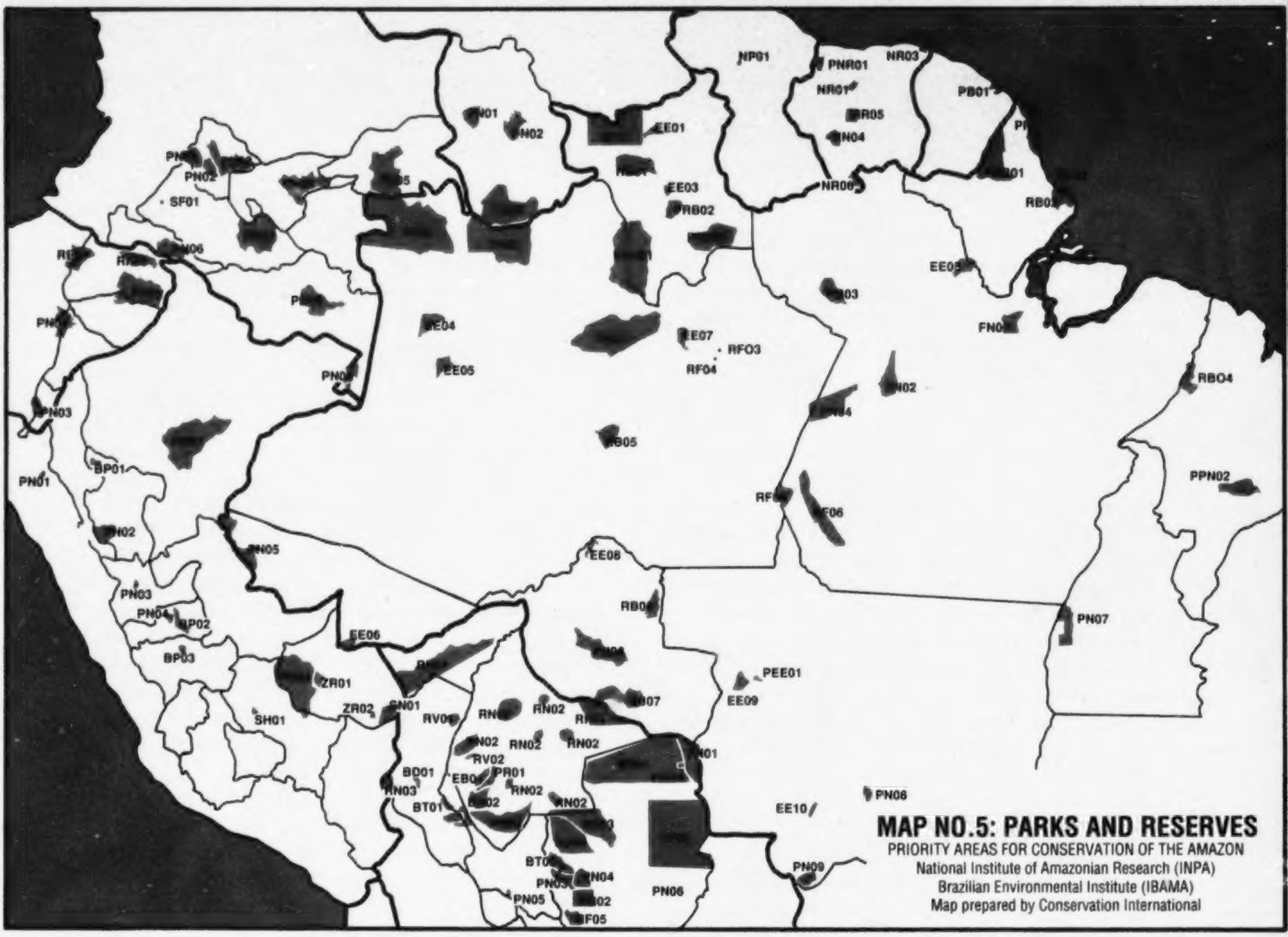
If we apply the living standard concept to an unspoiled indigenous people in the Amazon, it would be extremely low, because they have no electricity, physicians, schools, water, or drainage, nor any of the consumer goods typical of the developed Western countries. The logical conclusion drawn by applying the Western living standard variables would be that this group should be civilized and acclimated to Western culture so that it can acquire the same standard of living. But if we apply the quality of life variables, the picture changes. Now they do have freedom. They have their own identity, they are creative, and they have free time or leisure. They also play an active part in community life; their education is sophisticated in terms of understanding, and individuals have a close-knit family life and privacy. They are secure in a vital social setting, and they have what they need to subsist.

The general concepts of sustainable development, standard of living or quality of life in a given setting—such as Amazonia—should therefore be attuned to that reality. The concepts suited to the industrial cultures of other countries do not necessarily apply. Here a major role is played by the environment, which should be safeguarded in such a way as to guarantee the inhabitants a quality of creative living and an identity of their own that will ensure their freedom. Development in many parts of the Amazon region, where attempts have been made to implant alien living patterns, have failed either to sustain or improve the standard of living or the quality of life of the inhabitants. Poverty is widespread, social problems are acute, and the environment, as the supplier of resources, is deteriorating.

The Amazon region has major resources on hand to guarantee the self-sufficiency of rural and urban inhabitants. The Amazonian environment has a bountiful supply of hydrobiological resources and animal life, and enormous forestry resources, as well as minerals and hydrocarbons. In proportion to the population, these resources should guarantee high economic levels and an adequate quality of life (FAO, 1990). Nevertheless, there is poverty in the cities and rural areas, which can only be explained by the fact that the wealth being generated is distributed inequitably and the production systems introduced have not yielded the expected results. Domestic colonialism has caused the economic benefits to be exported from the region to peripheral areas and other countries. At the same time, pillage and the wasting of resources have weakened the potential for self-sufficiency.

Another factor to be borne in mind is the failure of migrants and settlers to adapt: their difficulty in living off the resources of the region is compounded by their lack of familiarity with the environment and its potential. Certain types of malnutrition, for example, are due to the change in eating habits. Foods are imported while the highly nutritious goods native to the region go unconsumed. The peripheral zones—especially the Andean and Northeast regions—are also plagued by poverty (at times, extreme poverty) and migrants come into the Amazon unprepared to cope with the new life that awaits them and unable to better their condition. Things are even worse if the new economic activities fail to get off the ground or if the migrants once again become caught up in the chain of man's exploitation by man because of low commodity prices or the sheer impossibility of placing products in distant or nonexistent markets.

The poverty of certain strata of the Amazon population should not be attributed to the region's inability to generate resources and earnings. It stems from patterns of domestic colonialism and the productive systems that have been introduced in the region. The major drawbacks of disorderly development are that it has destabilized the indigenous peoples, depriving them of their territorial security and resources and that it has led the settlers into development under conditions of poverty by encouraging them to engage in occupations that yield little return in the absence of technology, infrastructure and sustainable economic conditions (FAO, 1990).



MAP NO.5: PARKS AND RESERVES

PRIORITY AREAS FOR CONSERVATION OF THE AMAZON
National Institute of Amazonian Research (INPA)
Brazilian Environmental Institute (IBAMA)
Map prepared by Conservation International

BRAZIL
Forestry Reserves

RF01	Parima
RF02	Rio Negro
RF03	Walter Egler
RF04	Adolfo Duke
RF05	Mundurucânia

National Parks

PN01	Capo Orange
PN02	Pico da Neblina
PN03	Jau
PN04	Amazônia
PN05	Serra do Divisor
PN06	Pacáas Novos
PN07	Araguaia
PN08	Chapada do Guimarães
PN09	Pantanal Matogrossense

Proposed National Parks

PPN01	Rio Branco
PPN02	Mirador

Ecological Stations

EE01	Maracá
EE02	Maracá - Jipioca
EE03	Caraca
EE04	Juami - Japurá
EE05	Jari
EE06	Jutaí - Solimões
EE07	Anavilhanas
EE08	Cunia
EE09	Ioue Jurema
EE10	Serra das Araras

Proposed Ecological Stations

PEE01	Sema

Biological Reserves

RB01	Mucajai
RB02	Lago Piratuba
RB03	Rio Trombetas
RB04	Gurupi
RB05	Abufari
RB06	Jaru
RB07	Guaporé

Proposed Biological Reserves

PRB01	Oiapoque
PRB02	Rio Anauá
PRB03	Jatapu

National Forests

FN01	Caxiuana
FN02	Aveiro

VENEZUELA
National Nature Parks

PN01	Yapacana
PN02	Archipiélago los Roques
PN03	La Neblina

COLOMBIA
National Nature Parks

PN01	Cordillera de los Picachos
PN02	Tinigua
PN03	Serranía de la Macarena
PN04	Nukak
PN05	Puinawai
PN06	La Paya
PN07	Chiribiquete
PN08	Cahuinari
PN09	Amacayacú

Flora Reserve

SF01	Isla de la Corota

ECUADOR
Ecological Reserves

RE01	Cayambe - Coca

Fauna Production Reserves

RF01	Cuyabeno

National Parks

PN01	Sangay
PN02	Yasuni
PN03	Podocarpus

BOLIVIA
National Parks

PN01	Noel Kempff Mercado
PN02	Isiboro Sécure
PN03	Carrasco Ichilo
PN04	Amboró
PN05	Torotoro
PN06	Santa Cruz La Vieja

Biological Stations

EB01	Estación Biológica Beni

National Reserves

RN01	Manuripi Heath
RN02	Lagunas de Beni y Pando
RN03	Ulla Ulla
RN04	Noel Kempff Mercado

Forest Life Refuges

RV01	El Dorado
RV02	Estancias Elsner Espíritu

Permanent Protection Forests

BT01	Bella Vista
BT02	Sacta Ichilo

Immobile Forest Reserves

RF01	Itenez
RF02	Río Boopi
RF03	Covendo
RF04	Chiquitanía
RF05	Río Grande Mascicuri

Permanent Production Forests

BD01	Quinera del Aten
BD02	Chimanes
BD03	Guarayos
BD04	Bajo Paragua
BD05	El Chore

Regional Parks

PR01	Yacuma
PR02	El Piraí

PERU
National Parks

PN01	Cutervo
PN02	Río Abiseo
PN03	Tingo María
PN04	Yanachaga - Chimillen
PN05	Manu

Protected Parks

BP01	Alto Mayo
BP02	San Matías - Carlos
BP03	Pui Pui

Historic Sanctuaries

SH01	Machu Pichu

National Sanctuaries

SN01	Pampas del Heath

Reserve Zones

ZR01	Manu
ZR02	Tambopata

National Reserves

RN01	Pacaya Samiria

SURINAME
Natural Reserves

NR01	Raleighvallen/Voltz Berg
NR02	Wia Wia
NR03	Wane Kreek
NR04	Eilerts de Haan Gebergte
NR05	Tafelberg
NR06	Sipaliwini

Projected Natural Reserve

PNR01	Kaburikreek

GUYANA
National Parks

NP01	Kaiteur

FRENCH GUYANA
Biotope Protection Areas

PB01	Région de Kaw

The population of the Amazon has suffered the consequences of the absence of these two priorities. Most of the people have not found access to the market system. Others have acclimated but are at a disadvantage by becoming a part of the productive base of resources with no value added and low prices in the marketplace. Drugs or gold—which are more profitable than legal productive activities—become a logical alternative to such a system.

4.8 Education, Health, Housing, Transportation and Communications Services

Education, health care and housing are substandard because of the priority attached to patterns alien to the region and the failure to consider solutions native to the region. Traditional techniques of disease prevention and treatment, housing construction, and even of education were disregarded and either adapted or modernized. Amazonian tradition was dismissed in the belief that foreign ways worked better.

Education in the Amazon leaves much to be desired, although some experiences have been worthwhile. Illiteracy rates are relatively high. In Peru the rate is 10 per cent, which is lower than in the peripheral Andean areas. But cultural illiteracy is rising because curricula are not attuned to the Amazon in terms of either culture or environment. Years of organization and work by the indigenous peoples have elicited a degree of respect for their right to a bilingual education consistent with their culture. Some of the tribal peoples, such as the Shuar of Ecuador, have even set up a local radio station to preserve their culture and secure the instruction they need. Bilingual teachers have now achieved recognized status in the various countries (Arvelo-Jimenez, 1989; Compton, 1989; Chirif, 1989; Dominguez, 1989; Montero and Crespo, 1989).

Most of the courses are designed to teach the settlers how to live in present-day cities, and are out of tune with life in the region. The ecology, technologies and cultural aspects inherent in the region are ignored in the curriculum. The problem is still worse in colonized areas where the migrants stubbornly stick to their ways and there is a shortage of teachers, who have been sent to neighboring peripheral zones. As a result, the possibility of a basic education tailored to life in the region and to earning a livelihood there is gradually being undermined. Absurd ideas are encouraged, i.e., that cement is a better building material than wood or that imported milk is necessary for protein value despite native nutritional resources, such as fish.

Urban education further isolates the people from their setting and places them in a totally distorted, artificial world by its failure to interact with the environment or the potential of the region itself. In the future intensified effort will have to be devoted to education for life in the Amazon in keeping with local conditions, with broad participation by the indigenous population and extractivist population (rubber tappers, Brazil nut harvesters, et al.). Such learning should be geared to conserving local knowledge, techniques and cultures. Training local instructors and preparing appropriate textbooks will be key activities. The Amerindian peoples should be entitled to a bilingual education imparted by teachers from their own background and with local content.

If sustainable development is really the goal, one of the key aspects for the future of the region will be to embark on a path of education that teaches students how to live in and off the Amazon's own environment. The use of models alien to and detached from their own surroundings to teach inhabitants of the region would be the worst possible alternative.

Locally developed techniques for building traditional dwellings are both highly efficient and attuned to the environment. Underlying this experience is a wealth of knowledge about the best timber and other forest products for construction purposes (fibers, leaves, etc.), as well as ways to counteract heat and humidity. The traditional dwelling can be improved and modernized, not just replaced by imported housing. Even national laws have on occasion endorsed the use of cement and brick as basic building materials while disparaging local inputs as second-rate. In times of wealth, such as the rubber bonanza, whole structures made of iron or European materials were imported for the mansions of Manaus and Iquitos, and still stand as silent witnesses to neocolonialism.

In some cases, even the legal concepts concerning rural dwellings will have to be changed. In others, major savings can be made in remote zones by paying the inhabitants to build the missing infrastructure (schools, communal houses, and the like), using their own standards and patterns, instead of having the materials hauled over long distances. Builders and urban planners are faced with a real challenge in the urban fringe where environmentally suitable communities and buildings will have to be put up instead of overcrowded slums made even worse by the lack of green areas—especially in a region where there is an abundance rather than a shortage of space.

As the Amazonian population has grown, cities have sprawled and migration has expanded; sanitation problems have become more acute and disease more widespread. Malaria, yellow fever, dengue fever, cholera, and Leishmaniasis have all reappeared in the region and are gaining ground. The violent outbreak of cholera in the Peruvian Amazon has focused attention on the strains in the sanitation infrastructure throughout the region.

Lack of foresight, improvised solutions, and neglect may further worsen the situation, because no thought has been given to water and sewage treatment infrastructure in cities and towns. Sanitary conditions in most villages and towns are deplorable. Even when sewer systems do exist, sewage is dumped directly into waterways. Massive education of the population will be needed to guard against both new and common diseases, and stringent measures will have to be taken to improve environmental sanitation.

The Amazon today is not the same as it was in the time of the explorers, missionaries, and rubber barons. There are over 40,000 km of roads, dozens of airports, river ports, and direct international communications from several points, in addition to telephone service and television by satellite. These networks are the result of huge investments, but there are also tens of thousands of navigable rivers that are a natural means of communication and have cost the countries nothing.

The communications systems for rural settlers are nevertheless poor because of the distances involved. Widely dispersed occupancy was encouraged on many fronts, and this has made communication difficult and its maintenance expensive in areas with low concentrations of population and limited output. Solar energy and other innovative sources have been ignored; instead, engine-powered means have been used, with the attendant problems of operating costs and repairs in remote areas.

Highway construction in the region has had a heavy impact on the environment because of migratory movements, destruction of forests all along the roadways, and pressure on resources. The most neglected aspects have been land management, preparing the local population for change, and upgrading local government in the newly opened zones. Much of the highway infrastructure is expensive to maintain and has either been abandoned or is in very poor condition, making it a burden rather than an advantage to settlers. Another factor warranting serious consideration is the high percentage of land connected by the highways that has either been abandoned or yields very little. It would be irresponsible to think of building more highways that would simply replicate the same problems already experienced elsewhere.

While major investments have been made in highways, little effort has been made to capitalize on the waterways. Thought is even being given to transcontinental highways to link the Atlantic with the Pacific, but no serious consideration has yet been given to capitalizing on waterways and existing roads. Sustainable development of the Amazon requires that future priority be geared to consolidating existing highways, improving river transportation, conducting

HEALTH CONDITIONS IN THE AMAZON

An analysis of health conditions in the Amazon solely on the basis of the classic indicators of mortality, morbidity, etc., due to the lack of complementary data, would skew the result and reflect neither the type nor the scope of the true problem.

One of the common ailments in the region, malnutrition, is associated with the vicious circle of intestinal parasites, diarrheal disease, respiratory infections, malaria, yellow fever, and the like. Epidemics, which have decimated most of the indigenous peoples over the past 100 years, are still endemic in many parts of the Amazon. Recently cholera has been making more and more inroads among the Amazon's population. The high incidence of infectious and parasitic diseases in Amazonia is related to unsafe drinking water, which should be studied in-depth and addressed. Unsanitary food conditions, particularly in cities, are in part responsible for the region's high rate of gastrointestinal diseases and infant mortality. There is a lack of health care infrastructure and inputs; most health care posts are manned by unqualified staff from outside the region. The few cities that have better hospital facilities cannot cover the needs of a growing population. Rural inhabitants live several hours or days away from health care posts, most of which are inaccessible to the population in terms of cost.

The Amazon is rich in wildlife and has enormous medicinal and nutritional potential. Consumption of fruits rich in vitamins and minerals and fish with high protein content and other nutrients should be encouraged and provision made for food storage and preservation. A major contribution would be dissemination of knowledge about the health care practices of the indigenous peoples and upgrading of health care programs that use preventive medicine and native remedies, which would improve health care in the Amazon region. This would first require encouragement for programs to revitalize autonomous medicine and for ancestral know-how to be passed on from generation to generation. There is also a need for support for botanical, ethnobiological and pharmacological research geared to improving health and nutrition in Amazonia.

Source: *Bases científicas para estratégias de preservação e desenvolvimento da Amazônia. Fatos e perspectivas.* Chapter 5: Salud e nutrição. Toby Barret, Rui Freitas, Mariceide Naidd, Roberto Naiff. INPA, Manaus.

environmental impact studies before new highway projects are approved, and tailoring communications to local conditions. Highway consolidation is crucial for maintaining communications and for improving production in areas already opened. Millions of hectares of land are in a state of abandonment or produce little. With appropriate technologies, the yield could be much higher if adequate transportation were available.

Improvement in river transportation, which would be less costly than highways, is a solution that is not only viable but appropriate for the region and a boon to the local inhabitants living along the banks of the rivers. In the future, emphasis should also be placed on conducting environmental impact studies before launching major projects.

4.9 Violence and Lack of Security

More and more of the Amazon region is suffering the effects of the lack of security and violence arising from disputes over the ownership of land or of resources such as gold or contraband wildlife, the production and traffic in drugs or arms, and ordinary delinquency, terrorism and vandalism, in addition to ecological violence against natural resources. A guerrilla conflict approaching civil war is widespread in the Amazon region in Peru and Colombia.

The most serious conflict involves drug trafficking in areas of Bolivia and Peru where cocaine is grown and produced, and over international drug-trafficking routes, as in Colombia and Brazil. Drug trafficking, mainly in the upper Peruvian jungle, has triggered terrorist and guerrilla violence, and taken a high toll in human life and infrastructure, not to mention the political, social, economic problems and the immorality involved. Guerrilla bands in Colombia and Peru have sparked environmental disasters by blowing up oil pipelines between the Amazon and the Pacific coast. Tribal peoples in a number of areas have been involved in fights with guerrillas or drug traffickers, among them the Ashaninka and Yanesha nations of the central Peruvian jungle, who rose up in arms to defend their rights. Drug trafficking has become a problem that transcends country borders and the limits of the Amazon basin—a problem with which all states must cope, depending on its manifestations in each country.

Prospecting is another factor leading to violence in areas invaded by *garimpeiros* in search of gold and other minerals, and has extended beyond the borders of Brazil into the entire Amazon region. The resulting conflicts are generally with indigenous tribes or riverbank settlers. Colonized areas have been destabilized by the prospectors whose activities place the orderly use of resources in jeopardy. The massive influx of these people has also been responsible for the spread of diseases, such as malaria and AIDS, and other security problems associated with gangs and theft.

Squatters moving into new areas and competition over land ownership causes conflicts with indigenous groups and riverbank inhabitants who have no deeds to the land and no enforceable rights. In the oldest colonized areas, where the jungle dwellers were not given title to the land, whole Amerindian tribes have disappeared—in places such as Peru's Huallaga Valley. Conflicting claims of forestry, mining, and petroleum interests to lands the tribal peoples or miners consider their own by custom or deed lead to disputes and conditions of insecurity. Mining and petroleum concessions are granted without consideration of protected areas or titles to the land.

Despite wildlife protection measures enacted by the Amazon basin countries, illegal trafficking in furs, hides and live animals for export continues. Very widespread in the past, it has now been scaled back thanks to the International Convention on Trade in Endangered Species, which compels both the exporting and importing country to comply with strict controls.

There has been little discussion of ecological violence in the Amazon basin, with its ever greater impact on water resources, forests and biodiversity and direct impact on the supply of nutritional resources and traditional products for forest peoples and urban dwellers. Water pollution, logging, over-fishing, and over-hunting have diminished the resource base of the local inhabitants and frequently left them without food supplies, with attendant malnutrition, or without products to market. This has occurred on a wide scale in areas where rubber is tapped or Brazil nuts harvested and where concessions have been granted or land authorized for farming in the very same areas, with the resulting destruction of the trees.

One government after another has encountered serious difficulties in preventing conflicts. The Amazonian countries must therefore make a particular effort to prevent such clashes in the future by means of prompt and coordinated action throughout the basin when disputes cross national frontiers.

To resolve such conflicts, and in order to arrange for a consensus tailored to local conditions, the local inhabitants and those most affected will have to become more actively involved.

V

OPTIONS FOR THE FUTURE OF AMAZONIA

5.1 Choosing the Right Course

The Amazon countries have three alternatives on which to base the future of the basin: (i) continue with, or make no substantive change in, the present development style; (ii) halt or freeze development of Amazonia, in the expectation of additional decision-making data, creating no new ecological risks in the region; (iii) commence prudent but firm sustainable development, and let experience be the teacher.

The first alternative—although temptingly easy—would be irresponsible and untenable, given the overwhelming evidence that the current pattern is destructive and unsustainable in the medium term. No government can judiciously opt for that course, which would in essence play into the hands of short-sighted and short-lived economic interests, sacrificing this vital region along with the population groups that directly and indirectly depend on it.

The second option is to some extent being advanced by many developed countries that are concerned with their own security and fail to measure the sacrifices that would be imposed on the Amazonian peoples. Radical ecological groups are also encouraging this solution. Albeit well intentioned, they at times lack social awareness as they grant unrestricted priority to nature over man. Even so, the governments of the Amazon basin countries may find that this option—assuming it is socially viable in part of Amazonia—might be worth considering as a temporary measure. The concept of territorial or developmental reserves is not new and has merit as part of a long-term strategy. Venezuela has espoused this concept and many other Amazon countries have also established huge reserves using this same approach.

The third option favors very prudent development, on the premise that the quality of human life is inseparable from the safeguarding of natural processes in the medium term and particularly in the long term. This option is also based on what is socially desirable. It acknowledges that although provision must be made for future generations, the present generations have pressing needs that must be addressed now in the hope of a better future. This third option is the one known as sustainable development, recognizing that although we still do not have all the data needed to put it into practice, the best way to encourage it is by learning as we go.

5.2 Sustainable Development, Amazon Style

Sustainable development as described in the Brundtland report is development that meets the needs of the present generation without compromising the ability of future generations to meet their own. Socioeconomic development goals must be defined in terms of sustainability in every country. *Our Own Agenda* broadens the concept of sustainable development to include equitable growth, along with expansion at a rate needed to generate well-being for the entire population.

The concept of sustainable growth is highly utopian. Practically speaking, it is a complex approach that requires an enormous scientific and technological effort. For the people in the Amazon there is no time to lose. Meeting their legitimate aspirations is the primary goal and an essential step toward sustainable development. The historic precedent of native cultures and other forest peoples, as well as the recent effort of thousands of professionals engaged in science and technology research in the region, tend to encourage action. The lack of know-how should not be grounds for inaction. Amazonia will learn as it goes.

Amazonian development involves human development (UNDP, 1990 and 1992). In other words, it takes into account the needs of individuals in order for development to be more democratic and participatory. Many policymakers focus on the income dimension alone. In the best of cases, this would place the Amazon among the poorest and least developed regions in the world. Amazonian development must therefore be centered on the individual, i.e., development that engages the individual as well as being sustainable. To this end, the people of the Amazon must have a voice in developing their skills, health, education, and training. They must also have a chance to make use of their skills, to participate fully in every aspect of life and express themselves freely and creatively.

From the economic standpoint, the notion of sustainable development might be viewed as an attempt to expand the concept of efficiency over time to a natural resource context, i.e., resources that cannot be reproduced by the economic system (Pearce and Turner, 1990). The sustainable development of Amazonia would thus mean drawing on its natural resources in such a way as to maximize their production today without reducing their capacity to produce in the future. Despite its apparent simplicity, the implications of this approach are not always self-evident.

First of all, we should make it clear that safeguarding the Amazon's productive capacity necessarily implies that its stock of natural resources must be kept on an even keel. This would not be possible if the sole and exclusive benefit of natural resources were derived from their mere existence. Natural resources are factors in the productive process and their use also provides economic benefits. The decision therefore rests on getting as much as possible out of the total economic value of the resources, i.e., the sum of the liquid benefits gained from their use combined with their value as stock (Pearce, 1990).

Sustainable development in the Amazon, however, requires a number of short-term and long-term strategies, which as a whole should be conducive to a new direction for the region—strategies that depend on many agents, from the leaders of the Amazon countries down to the grassroots inhabitants. A new international order, based on principles other than those endorsed in the past, is therefore needed. The new strategies to be applied are described in the next chapter.

5.3 The Amazon—No Longer an Island

Focusing on the Amazon as an "island," a region detached from the rest of the world or from the areas bordering on the Amazon basin—both within and outside the countries exercising sovereignty over the area—has led to mistaken policies and wrong decisions. Amazonia is actually part of an intricate system of dependent parts, pressures and internal and external needs in the political, social and economic spheres. Discovering and understanding this system of dependencies poses a real challenge, and apparently little headway has been made. The Amazon region's dependence on national and international policies is a key aspect in proposing strategies for sustainable development of the area.

The region was never a separate entity in the development planning followed in the Amazon basin countries but was generally considered an area for relieving pressure on other parts of the country and as a domestic colony to exploit resources or solve short-term economic problems. The construction of major highways to and within the region—supposedly to integrate it with the rest of the country and develop it economically—were a pretext to relieve population pressures in other poverty-stricken regions without getting to the root of the problem where they occurred. In almost every case, the wealth of the Amazon was exploited to generate riches elsewhere, and with no concern for its endogenous development.

As a result of policies that focused on the region as a solution to domestic unrest or source of easy resources, Amazonia had no self-sustaining development, let alone sustainable development. The social problems of other regions were instead passed on to it; the current poverty of most of the Amazon population stands as palpable proof of that trend. For example, the oil pumped from the jungle of Ecuador or Peru has generated wealth outside the region but not inside it, except in the Department of Santa Cruz (Bolivia) where 10 percent is retained for local development. The same can be said of most agricultural products and, especially, cattle ranching. What remains in the Amazon are the social, environmental, and economic problems. During the military dictatorships of the 1960s and 1970s, emphasis was placed on building up national security in the region, and military colonization, especially settlements along international borders, were promoted. Coupled with these national development policies over the past 50 years were international policies of both governments and lending institutions that supported and financed large-scale projects involving human settlements based on agriculture, cattle raising, or mining.

Part of the problem was due to the widespread belief in both the Amazon basin countries and the developed nations that highways alone spark development. The region's dependence on the bordering zones is evident in the pressure for the settlement of new land in Amazonia caused by unjust land distribution, the shortage of land, and destruction of the soil. Such pressures would not have occurred without government highway programs, expansion of the agricultural frontier, and related fiscal incentives.

Nevertheless, neither the expansion of the agricultural frontier nor highway construction is directly responsible for the present-day problems, but rather political decisions based on mistaken ideas of what should be done and how to do it. The technologies used were unsuited to the ecology of the region. For example, 20 years ago cattle ranching and cultivation of the oil palm were thought to be major opportunities. Today we know that neither one is appropriate to most of the region, especially the former.

Economic pressures from outside, both national and international, also influenced land occupancy and the failed development programs. Economic interest groups promoted huge projects that were not as promising as expected. The Fordlandia and Jarí projects in Brazil and the Le Tourneau project in Peru are well-known cases that began amid heavy outside pressures and expectations, but which failed, leaving the countries holding the bag in terms of social unrest and economic burdens. Outside economic pressures are also being exerted today to gain access to mineral and forestry resources in the region, or simply on behalf of huge infrastructure projects that are backed by consulting firms, transnational construction companies, or their local representatives. Equally sizable in-country economic pressures are being exerted by economic groups organized to gain access to forestry, land and mineral resources. The case of the gold prospectors is a good example of how these interests work. Behind every miner there are vast financial interests promoting anarchy in the mining industry and who are the only ones getting rich. Another aspect of the web of Amazon interdependence is the demand for products to meet national or international needs, brought to bear especially by the so-called developed countries. Domestic demand for certain products has led to major decisions being taken on the exploitation of the Amazon, land occupancy and the construction of access highways into the region.

5.4 Dependence and Sustainable Development

The concept of the Amazon as a part of a set of national and international dependencies, pressures and demands is a basic element in any proposal for sustainable development made from the Amazonian standpoint. The superficial approach to the Amazon as an island must be discarded. Coming up with strategies and alternatives for sustainable development, bearing in mind the whole web of interdependencies in the technological, economic, social and political spheres and given the ecological and geographic heterogeneity of the region, is a truly difficult challenge —but one that can be met. The lessons of the past are a good guide for the future.

The region has seldom been the subject of proposals that are both sound and lasting, as well as comprehensive. Any attempt to propose alternatives for sustainable development that is both objective and sincere will first require a realignment of domestic policies. For this to be done, an objective approach would first have to be applied to the environmental, technological, economic and social conditions of both the region itself and, particularly, the peripheral zones. Frequently priority will have to be given to the acute problems confronting these outlying areas before trying to solve the ones in Amazonia.

Moreover, any proposal for sustainable development in Amazonia must include the concept of shared responsibility, without detriment to the sovereign rights of the countries of the Amazon basin and peripheral zones. Thus far, no specific projects or programs have been developed that embody a vision of the dynamics of the basin itself. Both the countries in the basin and those interested in the conservation of Amazonia have based their action on partially national approaches and on such topics as tropical forests, indigenous peoples, or biodiversity. Some have even been based on the contribution the felling of forests has made to world environmental problems. The utmost effort will have to be made, as part of a plan for sustainable development for the Amazon, to give each aspect its true weight as part of a whole that must be more comprehensive. Public and private, governmental and nongovernmental, bilateral and multilateral organizations should join in this comprehensive approach and become part of this network of national and international dependencies for sustainable development of the Amazon.

5.5 The Amazon and Global Ecological Security

The Amazonian ecosystems produce a multiplicity of goods and services, a considerable part of which are or could be traded commercially between producers and consumers. The value of these goods, such as forest products, mineral resources, hydrocarbons and hydroelectricity, can be established directly through the market. But those ecosystems have important functions in global ecological security. For example, they play a crucial role in the water cycle at the regional and global levels, as a reservoir of the carbon stored in its biomass, and as a huge bank for the wealth of biodiversity and germ plasm. Formally established markets through which costs and benefits can be evaluated and transactions eventually made do not exist for these goods. The possibility of preserving Amazonia hinges on establishing an adequate balance between the environmentally sustainable exploitation of goods with existing markets, and an effective assessment of and compensation for the functions and services Amazonia performs for mankind.

The tropical belt that surrounds the planet between the Tropic of Cancer and the Tropic of Capricorn is one of the most important regions on earth. This part of the world should be studied from a larger perspective in order to uncover its interrelationships at global level. These have seldom been set out clearly. Alternatives for sustainable development at the global and tropical level, and certainly for the Amazon, cannot be suggested without taking into account the complementarity of the tropics and temperate zones of the north and south. Here once more we should point out that the tropics, like the Amazon, are not isolated regions but part of a worldwide interrelationship in terms of the production of goods and services.

Like deserts, with appropriate technology the humid tropics can be irrigated and can certainly produce foods; in fact they do produce food, even to the point of exporting it. In Amazonia, many crops are grown that are essential items for national and world consumption, e.g., coffee, cocoa, papaya, rubber, palm trees, avocados, and bananas. But that does not conceal the fact that the tropics are severely limited in developing intensive agriculture of a conventional type. Most of the fertile land, in addition to being scarce, has been settled. Large areas are not farmed because the land has been degraded or abandoned or is being used for cattle ranching. What land is left has little natural fertility, most of the fertile land having been devoted to growing export commodities but not food. Therefore, the tropics and Amazonia with adequate technology and improved soils, can produce abundant food for a growing population.

The contribution of the tropics to the greenhouse effect or global warming is much less than that of the developed countries. By contrast, its contribution to the solution may be vital to man's future. The developed countries are responsible for 73 percent of the emissions of gases responsible for global warming, whereas agriculture and deforestation account for the remaining 27 percent. Deforestation occurs mainly in the tropics, but the share attributable to Amazonia is insignificant considering carbon dioxide emissions worldwide. Nevertheless, the developed countries find it cheaper to prevent deforestation in the tropics than to control their own carbon dioxide emissions.

Indeed, the estimated cost of preventing a ton of CO_2 from entering the atmosphere would cost $4 if the deforestation of Amazonia is controlled; $10 if emissions from vehicles and industries in the United States were reduced by 10 percent; $30 if Amazonia is reforested, and $130 if CO_2 emissions in the United States were reduced by 50 percent (*The Economist*, December 7, 1991). These figures speak for themselves and are significant in terms of explaining why the world is interested in compensating Amazonian countries, in clear market values, for reducing deforestation in Amazonia, as well as for reforesting and restoring abandoned and degraded areas.

Further, Amazonia is an enormous reservoir of carbon stored in its biomass which, if destroyed or burned in the short term, could cause a catastrophe of world-wide proportions. Moreover, the tropics could help to solve ecological problems if its vast areas, already deforested, were replanted. Reforestation of the tropics, owing to their uniform climate and rapid, year-round plant growth, would enable more carbon to be trapped and stored, and at lower cost and greater efficiency, than would reforestation of the temperate zones. It could offer plentiful employment and generate food (fruits, wild game, etc.) and industrial products for local settlers and for export.

The tropical zones, especially Amazonia, are repositories of untold quantities of fresh water and play an important role in the regional and global water cycle. Much of the earth's fresh water flows in the Amazon River, estimated by some to be 20 percent of the total. The Amazon also empties a sixth of all the water in the earth's rivers into the Atlantic Ocean. The destruction of the Amazon forests would cause an internal imbalance in the water cycle and in the total share of water in the atmosphere in the peripheral zones as well. Similar interrelationships are probable in the biogeochemical cycles, in which the Amazon has a very active share. The interdependent nature of each region on earth was shown when it was learned, for example, that part of the Amazon region's fertility may be due to the circulation of nutrients through the atmosphere in the form of precipitate dust originating in the deserts. It is estimated that nearly 200 million tons of dust are blown off the African deserts each year and that some 12 million tons fall on the Amazon region and help fertilize it, especially with phosphates (Booth, 1991).

The tropics play a major role in the conservation of the earth's biodiversity in terms of ecosystems, species and germ plasm. Key and unique ecosystems of tropical forests, deserts, dry forests, savannas, lakes, rivers, mangrove swamps, marshes, coral reefs, etc., are found in tropical zones. Some tropical countries have enormously varied ecosystems, such as Peru, which has 84 of the 104 life zones identified in the world. The nations with the greatest megadiversity in wildlife in the world are in the tropics (Map 3). The tropics contain a high percentage of the wildlife species and the highest rate of wildlife diversity by area. Thousands of tropical species of plants are useful for many purposes, particularly for nutrition and medicaments. In the Amazon alone, 2,000 species of plants used as medicines by the native population and that have pharmaceutical potential have been recorded.

The tropics also have a wide variety of native germ plasm of crop plants. The tropical zones and Amazonia have given the world many species of plants that are cultivated in other tropical regions and that have been adapted to temperate climates. The inhabitants of the northern hemisphere have forgotten that many of their most common crops are of tropical origin, e.g., potatoes, corn, rice, soybeans, tomatoes, sugar cane, peanuts, sweet potatoes, various kinds of beans, and the like. The tropics still have many varieties of crop plants unknown elsewhere. The Andean countries alone grew 155 species of crops during the pre-Hispanic era, some of them with thousands of varieties, such as the eight species of potatoes grown at sea level and up to 4,750 meters above sea level. This germ plasm is important, for the varieties and wild species of the crop types are found in the countries of origin.

The tropics also provide recreational services, especially ecotourism. They also contain broadly diverse native cultures with knowledge and techniques of great importance to endogenously based sustainable development. These groups have made major contributions to mankind in the form of culture, agroforestry techniques, domestic species of plants and animals, arts and crafts, music, processed products, etc. In the future their contribution may be much greater and decisive in terms of medicines and technologies. Many solutions to worldwide problems posed by new diseases are expected to be found in tropical zones.

In general, Amazonia is a territory rich in mineral (Table 8) and hydroelectric potential, hydrocarbons and land suited for agriculture. It is interesting to note, for example, that land suitable for cultivation only in the Amazon section of Brazil, representing 60 percent of the entire Amazonian region, could be increased an estimated 60 or 80 percent, that the Brazilian Amazon contains 45 percent of the country's hydroelectric potential and that the value of its mineral resources could reach $1.6 billion in 1989 dollars. The lumbering potential is estimated at some $1.7 billion in 1984 dollars. Although aggregate data for the entire Amazon is unavailable, a simple extrapolation of these figures to include the other countries of the region provides a revealing glimpse of the magnitude of potential resources which the Amazon holds for its inhabitants—to wit, more than $10 trillion. It is important to note some of the goods and services that the Amazon may provide which still have not been assigned a clear market value, namely, biodiversity, the value of the region in maintaining global climatic stability, and its crucial role in the water cycle.

TABLE 8
BRAZILIAN AMAZONIA: QUANTITIES AND ESTIMATED VALUES OF THE PRINCIPAL MINERAL RESERVES*

	Millions of tons	% of National Reserves	Value (millions of US$)
Niobium	81.5	6.0	1,067,519
Iron	17,705.2	35.3	315,330
Calcium	949.2	80.3	58,107
Aluminum	3,861.8	80.5	49,724
Potassium	335.3		24,007
Copper	9.3	83.3	22,354
Nickel	1.6	19.9	18,080
Total			1,555,121

Source: Santos and Ricker (1988)

* Based on 1987 data, according to the IBGE (1989).

The above illustrates the complexity involved in conservation of the Amazon and shows an order of magnitude of the compensation that the Amazonian countries could legitimately claim for reducing deforestation and to assure that exploration of their resources be done at cost and in environmentally rational terms. This dynamic balance can be achieved to the degree that the countries optimize the value of their resources, both those resources which have market value and those that do not, where cash equivalents may be determined. The industrialized nations must be prepared to compensate the countries effectively in order to stimulate conservation of the Amazon region and to develop the region in sustainable and environmentally rational terms.

To facilitate this dialogue, it is essential that the Amazonian countries evaluate their resources and the revenue that they could produce annually. The industrialized nations which reap benefits primarily from other goods and services produced in Amazonia may set the opportunity cost of alternate options, such as reducing the emissions of CO$_2$. These resource flows would thus provide estimates leading to the establishment of the levels of transfers which should be made to the Amazonian countries.

5.6 A Desirable and Achievable Future

A future that is both desirable and feasible for Amazonia must necessarily be based on a regional commitment, compatible with national commitments, representative of an authentic desire on the part of the people—one free of pressures or any contingency whatever. This is the only way for a regional development plan to come about that is viable. This is the only way to an understanding of the hopes of the Amazon peoples for a better future, a life that is socially just and environmentally sound. Citizens' rights in the Amazon countries must be respected in any present or future changes made in the region. Economic growth must be coupled with a social program to meet priority demands and to promote more ecological equilibrium so that man can live in harmony with nature. Stated briefly, Amazonian development must (i) be self-sustainable in the long term, making it necessary to safeguard natural cycles and systems, protect the interdependence and harmony between and within ecosystems and preserve the region's biological diversity; (ii) be based on involvement and self-determination while providing more socioeconomic opportunities conducive to a better quality of life for its inhabitants; and (iii) ensure protection for biological diversity, even from an evolutionary perspective.

There is no universal model for making development sustainable, much less one designed for the Amazon as a whole. Each country and region is a special case unto itself, totally dependent on local social and ecological features, as well as the national political context. In general, a more or less objective picture might be as follows: (i) part of the land (a relatively small part, given the scarcity of high-quality soil) is earmarked for single crops and yearly crops; (ii) a larger area is assigned to permanent crops, including cash crops; (iii) another portion of the land will be used to raise livestock, mainly beef cattle, which can also be fed processed agricultural and forestry wastes; (iv) another part of the land, especially where the quality of the soil is not very good, is set aside for agriculture or cattle on a rotating or sequential basis; (v) most of the forests would be geared to supplying products of some kind and/or environmental services (carbon fixation, water quality, erosion control, air quality, fauna maintenance, genetic resources, recreation, etc.); (vi) land under forestry management should also be used for wild animal management; (vii) almost all water resources should be subject to fisheries management; (viii) a large percentage of the land, regardless of soil quality, should be part of a national system of protected areas including natural parks and others; (ix) whenever necessary and compatible, mineral and oil exploitation would be possible, along with an energy infrastructure. Clearly, the environmental requirements on these activities ought to be more strict than on fragile temperate ecosystems.

In other words, land use ought to be based on its total natural capacity, should cover the long-term needs of the people living in the Amazon and, secondarily, the need of other populations through the export of goods and services, in such a way as to avoid jeopardizing the sustainable nature of development. Most of the land, however, should be maintained as natural forest, and managed for the production of economic and environmental goods and/or services. The landscape in the developed areas of Amazonia might resemble a gentle combination of farmland, pastureland and woodlands, the latter being much more extensive or adjoining large conservation areas in order to guarantee the long-term maintenance of species and biotic communities.

The search for an adequate quality of life for the inhabitants of the Amazon requires that social, environmental, economic and technological aspects be revamped and tailored to conditions in the region, guaranteeing the needs and aspirations of the distinct peoples who live there. The quality of life is not just one more demand of sustainable development but a means of lining up environmental priorities so as to bring about economic growth without detriment to the major advances made by the people of the forest and others in the region. Developing a region first of all means generating products and profits for the local inhabitants before exporting wealth to other regions. The production of goods and profits in turn means that population and environment must be kept in balance in order to prevent deterioration of resources.

Amazonian development must be linked to a whole set of factors and procedural considerations inside the region and in the rest of the world. This would involve a new approach to science and technology and may lead to a redefinition of labor and realignment of productive activity. Here biotechnology emerges as a source of widespread impact on a wide variety of activities and economic sectors. Biodiversity is one of the key components in this combination of processes with repercussions abroad and regional potential, thus opening up a wide array of development possibilities and opportunities for Amazonia.

The different development prospects require that there be a resurgence of growth in the region, which today is at a standstill, through the use of stronger socioeconomic and environmental policies that would open the way for technological advances. At the start, the Amazon must continue to be a supplier of raw materials and grow at a moderate pace under a working economic stabilization policy and the normally slow rate at which science and technology change takes hold. The growing domestic demand and gradual rise in the overseas market for natural resources should be followed by a progressively evolving restructuring of the economy and more environmental protection programs.

In a desirable future, the reforms under way would work to keep earnings at home to provide a better quality of life for the people of the Amazon. Development policy should be innovative and coherent, constantly seeking balance with environmental policy. The latter would in turn revamp natural resource exploitation and gradually abandon the conventional standards that grew out of modest retention of income. A prompt recovery in the quality of life of the Amazonian peoples calls for a combination of available and viable external economic processes and regional potential, implementing innovative development policies that would lead to a new Amazonian society. Such a society must be based on sustainable development with high technology and better quality of life.

Amazonian development strategy must therefore be supported by and focused on both ecology and technology, through a regional development model that reconciles environmental protection with economic growth and promotes a better quality of life for the people. Land management carried out with ecological and economic standards is vital for the identification of nature's potential, thus making it possible to build an environmental policy conducive to more orderly use of natural resources, minimizing damage to the environment and thus ensuring higher productivity.

It is also important to promote a regional science and technology system, with the participation of every country in Amazonia. The goal would be prompt attainment of medium, and later, higher levels of technology, through the assimilation of worldwide scientific advances. (The countries' relative lags in science and technology and their lack of human and financial resources must also be kept in mind.) The Amazon would then have major centers producing know-how and technology, strategically located to comprise an interactive hemisphere-wide network at the service of the Amazonian nations. This will substantially boost per capita income and give local entrepreneurs a larger share in capital installed in the region, which will in turn lead to better qualified and better paid regional manpower. The result would be considerable expansion of the domestic consumer market in Amazonia, whose population will have higher per capita earnings equitably distributed among every social segment of the region. The ensuing increased demand for durable consumer goods will provide stimulus for a productive system keyed to regional inputs.

The region ought then to undergo a process of territorial reorganization, encouraging industrial decentralization and distribution suitable to its environmental conditions. Urban areas should be renewed and overcrowding in major cities remedied by providing inducements for people to relocate. Medium and small-sized cities would improve and would then act as catalysts in settling the region.

The steps described above would benefit underpopulated areas, through an economic system directly tied to influences and choices derived from the territory itself, as land management gradually reveals differentiated economic potential for areas prioritized for ecosystem conservation; ongoing and comprehensive forestry management; hydrobiological resource management; stimulation of production in areas already settled; and territories for tribal peoples. Land management will thus perform its proper function in the economy by gradually reducing and eliminating anarchistic land-use practices. Accomplishment of these goals will require public and private investment in economic infrastructure conducive to the gradual solution of energy, transportation, communications, and basic service problems.

Considerable investments must be made in the energy sector in medium- and small-capacity hydroelectric plants, thus averting the economically inadvisable construction of extensive transmission systems. Emphasis should be placed on investments in alternative energy sources, mainly solar energy, natural gas powered thermoelectricity, and wind energy, all of which are highly suitable for the natural conditions prevailing in the Amazon.

Intermodal transportation should be introduced, with priority given to waterways interconnected with highways and rail transportation. The communications system should be enhanced by introducing satellite communications. Gradual implementation of the economic infrastructure should include social infrastructure, particularly basic sanitation, public health, nutrition, housing and education.

The lack of sanitation and water supplies should be gradually reduced until there is full coverage in urban areas, later extended to rural areas. This would have immediate repercussions on public health, which will further benefit from increased and better distributed regional income and additional food production, conducive to improved nutrition and a better diet for people living in the Amazon.

These interacting services, plus a reduction in educational deficits, will encourage substantially better public health in Amazonia, with the systematic and rapid reduction in endemic disease, rates of mortality and epidemics. Life expectancy would increase. The starting point for economic development of Amazonia is the planning of mining activity, thus far conducted only empirically and with little technological support.

Mining has some of the most devastating effects on the environment, causing irreversible damage to nature and some of the most worrisome social problems, e.g., the *garimpo,* squatter settlements inhabited by gold prospectors. Efforts should be made to regulate and industrialize mining activities and to implement technology packages for alternate activities, thus providing new job possibilities.

The harvesting of crops ought to be optimized by replacing and modernizing inefficient traditional methods. This would open the way for increased, controlled production while protecting the environment. Gradual, systematic support for forestry will be promoted by integrating it into the regional productive base. Artisanal fishing should be duly supported and given incentives by encouraging the expansion and modernization of the fisheries sector. The target would be the regional market as well as the entire domestic market and consumers abroad, based on careful management of hydrobiological resources.

Agriculture should be geared to areas where there is potential, as indicated in the land management surveys. Output should be planned on the basis of suitable and advanced technologies tailored to the species and environmental conditions. Some additional areas, probably the *várzeas,* could be brought into production after carefully considering protected areas in order to avoid damaging local fisheries.

Small and medium farmers should be given encouragement with guaranteed financing and technical assistance support. Remedial action in degraded areas should be intensified, mainly with reforestation, the cultivation of perennial crops and agroforestry. Agricultural policy should be based on modern methods of production and technologies suited to the region. Soil improvement should be encouraged and land for cultivation determined on the basis of objective criteria. Livestock production should be undertaken solely in areas specified in land management studies, with priority on those already intervened and targeted mainly to natural fields and savannah lands.

The forests must be used sensibly and placed under sustainable, comprehensive management. The logging industry and other forest production should be a key instrument in sustainable development of the region through the utilization of natural regrowth and reforestation processes. Subsidiary industries such as the manufacture of housing, furniture, domestic goods, office equipment, etc., will depend on them.

Industrialization must be introduced slowly and gradually, beginning with the consolidation of industrial enclaves and complexes that already exist or are being implemented. New plants should give priority to local inputs and capitalize broadly on natural resources available in the region. They should take an active part in research into local resources. Bioindustry and agroindustry, particularly pharmaceuticals and cosmetics, as well as food products, should be accorded priority. The gem industry, metallurgy, electromechanics and the electronics industry are a few examples of what should be implemented through the selective use of socioeconomic policy instruments in the region. Such projects should first address the goals of the regional industrial program, including the environment, through careful assessments of the environmental impact conducted prior to their initiation.

One potential source of revenue for the region may be ecotourism. The development of crafts, if properly planned, might serve as a complement to ecotourism, becoming a profitable program at the regional level, particularly emphasizing the artisanal skills of the indigenous peoples.

Based on the above, we believe that the desirable future for the Amazon, within the parameters contained in this document, will necessarily be an achievable future. This will involve a combined effort undertaken by all the forces for development in each country in the Amazon, between the countries of the basin and with the international community.

VI

STRATEGIES FOR SUSTAINABLE DEVELOPMENT

6.1 Using the "Standing" Amazon

A large part of Amazonia has still not been seriously affected by deforestation. Genetic resources, species and ecosystems found in that portion can be used within the Amazon in its present state, i.e., without destroying the natural productivity of aquatic and forestry ecosystems. Various possibilities exist for sustainable and profitable development: the management of forests and hydrobiological resources, extractive activities that take advantage of biodiversity, wildlife management, and ecotourism.

Sustainable and integral forestry management is one of the most promising ways to use the Amazon by taking advantage of the timber and different wood products prized by national and international markets—all the more so because of progressive thinning of the Asian and African forests that are the traditional suppliers of tropical hardwoods. The countries in the basin have already made notable strides in setting up national forests and woodland preserves covering millions of hectares throughout the basin, thanks in part to important research programs on tropical forestry and technology for the cutting and use of timber.

The considerable efforts already expended to establish national, state and municipal forests and the organization of forestry exploitation in those or in other public or private woodlands by commercial companies should be continued and improved. Forestry concessions to private enterprise should be granted on a long-term basis so that implementation of forestry management plans can be required: this would avoid the plundering of natural resources and ensure private-sector interest in such operations. It is also recommended that private as well as state ownership of woodlands be permitted, as a way to encourage sustained investment and effective management of this resource. This would have the further advantage of enlisting the help of the concessionaires or owners in protecting such areas from illegal or de facto settlement.

A number of countries have had interesting experiences in forestry management, such as strip planting, which allows the cutting of large volumes of wood per hectare and natural regrowth without the need for reforestation. The fact that there are no broad stretches of natural woods under management in Amazonia is a direct consequence of the lack of guarantees on ownership of the resource, plus the absence of incentives for management as compared with the profits that can be derived from uncontrolled and destructive exploitation with no real penalty for the perpetrators.

Integrated utilization of all woodlands under permanent forestry management must also be promoted, for this could produce income in addition to the return on lumbering. The practice in the region has been to skim the cream off the forest—to selectively cut a very few species, unjustifiably considered to be particularly profitable—while wasting most of the others, which are actually just as useful and valuable. Management of wildlife, utilization of products other than wood (resins, rubber, food, fibers, and the like), and even ecotourism can perfectly well be combined with orderly extraction of timber.

Finally, more prudent use must be made of forest products, reducing wastage which can be as high as 70 percent of the lumber extracted and utilizing what's left over for byproducts (charcoal, crates, etc.) and for biomass energy. This will allow broad stretches of woodland to be preserved, guaranteeing sustained production while ensuring the permanence of the region's environmental benefits.

Extractive systems for natural resources offer other important ways to use the standing Amazon. The countries in the basin have had practical experience in this respect, including extractivist reserves in Brazil, communal reserves in Peru, and Indian reservations in Colombia. Today as before, extractivism is a significant factor in the basin's economy, but it can become much more so in the future. The extraction of rubber, Brazil nuts, chestnuts, medicinal plants and other products and work in arts and crafts can be more profitable than extensive stock-raising and perfectly compatible with forestry extraction. The customary diet of urban Amazon dwellers is such that there is an excellent market for fruit, game, and other commodities.

The rediscovery of extractivism as an alternative to destroying forests and using the land for farming or ranching is nevertheless a recent phenomenon, triggered by the struggle of Brazilian extractivists to preserve the land they, like their forefathers, have long been working. The murder of the rubber tappers' leader Francisco Mendes in the Brazilian State of Acre marked a new stage in recognition of the possibilities offered by extractivist production. As a result, numerous tests are being made today to improve and strengthen the concept of extractivism, especially in the states of Acre and Rondonia. The main problem with extractivism is its economic viability, since for the moment only a few of the thousands of potentially valuable animal or vegetable products are on the market. Then, too, the plants that yield such products are scattered over a vast area, making their use difficult and expensive. Another problem is the cost of the technological research that would provide those natural products with access to markets on terms attractive to the producers. The solution to that problem will require considerable efforts in science and technology. Finally, this alternative also contains some implicit difficulties in terms of the management of resources, to the avoidance of overexploitation. Some ingenuity is also required to provide the social infrastructure to improve the quality of life for the extractors.

Management of the hydrobiological resources of Amazon lakes and rivers is an important undertaking today, especially for the supply of fish-based proteins— but this involves extensive depredation which cannot be allowed to continue. The establishment of areas for the management of these resources is imperative, particularly for the sustainable supply of protein for local and urban populations, which are constantly growing and which are more and more dependent on imported food. Efforts must also be made to make fish breeding an ecologically sustainable and economically attractive activity. Amazonian fisheries suffice to meet the needs of the present population, but will be unable to meet future demand, particularly from the growing number of city dwellers. Research conducted by INPA shows the indices of productivity reached by fish farming in the Amazon to be about five tons per hectare-year—150 times the amount produced by ranching (Gama and Silva, 1987). Intensive breeding of tropical fish for home aquariums and certain other aquatic species is another venture worth considering. With the development of tourism, even sport fishing of Amazon species can be promoted if it is properly controlled.

Wildlife management offers interesting possibilities, whether in areas under forestry management, or in semi-intensive and intensive management, including the breeding of animals. Many species of game are prized for their meat (boars, rodents, venison, and others). Some of the denizens of the woods are internationally important, such as primates for biomedical research and certain birds that are used as mascots. In the future the region will be able to supply local and world markets with species produced in areas under sustainable management and in animal breeding facilities. The breeding of wild animals and rational cropping of managed areas should be promoted in this context. Breeding of certain species (alligators, butterflies, etc.) could become profitable, as shown by experience in other tropical areas such as Thailand and New Guinea.

Ecotourism in the tropical Amazon woodlands represents an increasing indirect use of natural resources. Various experiences in this field attest to the profitability of such ventures and suggest the prudence of using everything the Amazon has to offer for this purpose. Tourist facilities are available in every country, and the influx of foreign tourists is constantly rising. In some cases, private entrepreneurs manage natural areas efficiently and combine tourism with biological stations where top-quality scientific studies are conducted.

Utilization of the biodiversity of the Amazon's ecosystems, especially to obtain new medicines and industrial products, is arousing ever greater interest on the part of industry, especially in the northern hemisphere. Species that in the past were considered harmful or unimportant have acquired economic significance; a case in point is the extraction of venom from snakes for medicinal purposes. The uses of biodiversity can be combined with forestry management; various types of protected areas; indigenous territories; and extractive reserves. Future strategy should be geared to the study of the different species, the search for markets, and the guarantee of a fair profit to the local inhabitants.

The use of hydro resources for energy is another possible way of conserving and earning a profit on broad expanses of woodlands, especially in the mountainous periphery of the basin. In addition to providing water and hydroelectric power, these resources can be combined with tourism and recreational activities, scientific research, and the utilization of biodiversity.

A further option for using Amazonian resources is the provision of services for population centers—for example, by conserving water quality and ensuring regular flows, or by avoiding landslides and floods that could damage the infrastructure. The cities of the Amazon also need to preserve nearby nature areas for recreation, cultural and business activities, but land management planning and conservation practices will have to be implemented for that purpose.

6.2 Development of the Settled Amazon

Conventional agriculture should not be considered a priority in the settlement of the Amazon, given the relatively poor soil and ecological impact of this activity. As noted earlier, however, we must not overlook the existence of some 300,000 to 400,000 square kilometers of fertile land scattered throughout the Brazilian Amazon alone. Economic utilization of the parts with the best soils might in the future constitute an important addition to the total acreage of available land in the Amazon countries. Perennial crops of native species should be practically obligatory in hilly terrain and the Andean spurs.

Although the savannahs in the Amazon lack the wealth of diversity found in the surrounding woodlands, they are still prone to various diseases. Special care ought therefore be taken to guard against the possible impact that farming and reforestation activities might have on the biota. Homogeneous forest planting should not be permitted in natural forests because of their lower resistance to regional pests, which in turn call for the use of pesticides and other chemicals that pollute rivers and air and impair the natural acidity and low natural fertility of Amazon soils. Accordingly, the only forestry projects to be permitted in the Amazon woods are those used by industries that utilize native species, based on management plans featuring natural regrowth.

But even more important than devising new ways to expand the farm frontier is proper use of the startlingly underutilized land already cleared for this purpose, in which copious investments have been made. The Amazon has between 80 and 100 million hectares that have now been opened up and settled, more than 60 percent of which has been abandoned and left in various stages of degradation. The remainder is used for low-yield farming. The objectives of sustainable rural development should be aimed at boosting the production and productivity of the land now being used and restoring the abandoned areas to productive status.

The best chance of sustainable development, then, is to consolidate the use of all farmland previously readied for agriculture or ranching by applying appropriate technology that will ensure sustained production while avoiding soil degradation. Numerous systems and experiences of proven effectiveness and profitability have been developed for this purpose by agricultural research services and by the farmers themselves in every country of the region. These options include agroforestry, the combination of forestry and pasturage, and a variety of annual and permanent crops, both native and imported. Efficient and highly productive technologies have been tested in different parts of the region, such as the rotation of woodlands and crops (e. g. the production of coffee and cocoa as an example of agroforestry, where the yield has been six to ten times the average level), plantations of native palm trees, and many others. It is also important to try to shorten the fallow periods in fertile ground, where the resting period is actually based on the technical inability to control weeds, particularly when it is easier to fell trees and restart the cycle. This is solved by simple mechanized techniques, and by the use of animal plowing in small or medium-sized plots. Application of this system would enable each hectare currently being used for agricultural purposes in

ALTERNATIVE TROPICAL FORESTRY— SURINAME'S "CELOS" SYSTEM

Research and experiments conducted on the management of natural systems for regeneration of tropical forests in Suriname in the past ten years suggest the possibility of applying an ecologically and economically viable system for their utilization. In all types of woodlands, with poor soil and low density of human population, lumber productivity can be increased and a sustainable supply of the resource attained by dint of certain management techniques. They consist of controlled extraction of no more than twenty cubic meters of valuable hardwoods per hectare every twenty years, coupled with a closely monitored system of selection and felling. This approach is complemented by singling out the best trees and using herbicides to control unwanted specimens three times during the cycle—at the start, in year 8, and in year 16—thereby boosting the economic value of the product. The basic principle governing the entire system is permanent maintenance of minimal interference and high levels of biomass to prevent erosion and loss of the ecosystem's nutrients.

Experiments such as these show that tropical forests have a much higher potential for lumber production than pessimists would have us believe. The gains in the short term would nevertheless fall short of those yielded by the more drastic method of one-time, destructive use.

The secret lies in understanding nature and imitating its ways, adjusting the scale and pace of human intervention and the extraction of resources to the dynamics of nature's own self-maintenance system.

Source: De Graaf, 1991

Amazonia to produce several times its current yield, thereby virtually obviating the need to continue expanding the farm frontier.

The recovery of abandoned land and its restoration to production should also be a priority strategy, and there are various ways of going about it. Much of the abandoned land is covered with various stages of secondary vegetation and stubble, known locally as *purmas*, *rastrojo* or *capoeira*. Management of such secondary growth to produce wood for fuel or for pulp and paper manufacture is profitable as well as feasible. A number of experiments carried out in the basin and in other tropical regions suggest concrete possibilities for wildlife management, harvesting of medicinal plants, beekeeping, and the use of highly valuable species for forestry enrichment.

Reforestation of abandoned land offers another opportunity to establish forests of valuable native and imported species for industrial purposes. The areas thus rehabilitated can quickly be readied for forestry and permanent crops. Various experiments with native crops—palm and fruit trees—have yielded excellent results in degraded areas. It is often simply a matter of giving the natural plant cover a chance to come back, while avoiding the use of fire or continuous deforestation. The restored areas are generally ready for agroforestry and permanent cropping fairly soon.

Cropping of permanent species has proven to be one of the best means of sustainable production and recovery of degraded areas in all tropical regions. Plantations of palm trees and various native fruit and forestry species—especially the leguminous varieties—have been successful, but have not yet been widely adopted.

Finally, one of the requisite strategies is the development of appropriate ways to exploit minerals and hydrocarbons that will avoid unnecessarily severe impacts on the Amazon's ecosystems and permit recovery of areas degraded by such activities.

6.3 Participation by the Amazon Peoples

A fundamental trait of the Amazon peoples is their identification with nature. Anyone who endangers the Amazon ceases to be a part of the place and its culture. Certain conditions that will enable the Amazon peoples to act in the best interests of their future have not yet been met, however, mainly due to the centralist approach prevailing among Latin American governments until a few years ago. The flowering of democracy in the region has given people a better chance to help shape their own future. New models for public participation must be developed, however, to allow people to discuss and take part in the region's decision-making process pursuant to their priorities. National governments should make sure of input from their citizens, particularly in mapping out socioeconomic policies for the region.

Among the Amazon peoples, settlers are especially important because of their numbers, and because their status as recent arrivals means that they are not necessarily imbued with the spirit enabling them to enjoy a good relationship with the natural environment in their new home. It is therefore essential to organize migratory flows better, where warranted, so that there is an opportunity to educate the newcomers and pass on to them the lore of the natives and long-term farmers in the region. Essentially, this comes down to enlisting their help in preserving the forests, so that they will avoid the simplistic tendency to cut down boundless stretches of woodland, repeating the mistakes made by their forefathers in the places they have just left—which cast them out for that very reason. That new colonist culture can be achieved if an organized approach is used, encouraging ties between the newcomers and those who have preceded them or, better still, with the natives. It will not be easy, since both parties have preconceived ideas which are fed by constant conflicts, but they represent nonetheless a formidable opportunity. Furthermore, settlers from other parts of the Amazonian countries also have a cultural legacy that can be applied to development of this area. For all these reasons, governments—and particularly authorities in the agricultural sectors—are urged to renew their efforts to find more innovative alternatives in terms of rural extension, stimulating full-fledged participation by settlers and locals. The settlers will of course have to be trained to face the challenge of the Amazon with an Amazonian perspective. But it is equally important to recognize that the sooner they feel completely in control of their own destinies, the faster and more effectively they will be assimilated. And this will only be achieved to the extent that clear-cut participatory mechanisms are established, without disparaging the sound advice of officials, which is indispensable for their guidance at the start.

Extractivist peoples have had a great deal of experience in utilizing the biodiversity of woods and waters, and their production systems have not only been economically important to the region—especially in supplying foodstuffs and other commodities—but have also been helpful in harnessing the potential for today's Amazonia for management of the ecosystems.

Participation of the Amazon peoples has in general been the cornerstone of a sustainable development process. If we are to improve present participation levels, all-out efforts are needed to decentralize and streamline administration and improve public education. Both factors provide the conditions for effective participation, bringing decision-making down to the local level and furnishing the criteria each individual needs to make the right decisions, i.e., to make a prudent choice of options to resolve conflicts. A first step in this direction is broadening of the decision-making base—not simply delegating those powers to elected municipal officials, but making greater use of open discussion of all matters affecting the community. The highly promising experience of the "green councils" instituted in Colombia and that of the environmental committees of Brazil's municipal councils can be replicated and expanded to reflect the individual features of each country and region. In Brazil, for example, those initiatives are currently being strengthened by building up the National Environmental Fund to finance environmental activities launched by the communities.

Permanent grassroots consultation mechanisms on issues such as the environment, which affect everyone, should also be established at the state, regional, or departmental level. The state or regional legislatures should set up periodic consultations to guide legislators in drafting laws governing the use of natural resources. Regardless of how democratic the electoral processes may be, those elected should receive guidance from their constituents during the period between elections. Grassroots organizations, such as labor unions, guilds, cooperatives, federations, and any others that assemble a public organized in connection with any productive activity should have a distinct voice in public management. They also deserve the encouragement and support of state agencies. The same should obtain (while ensuring that they are truly representative) for nongovernmental organizations of an intellectual nature, whose voluntary contribution could be an important source of new ideas.

6.4 Applying the Ancestral Wisdom of Indigenous Peoples

The peoples—natives and extractivists—who live in the Amazon rain forest or depend on it for a living have an essential role to play in making sustainable development possible in the area. As noted earlier, sufficient use has not been made of the knowledge, technologies and cultural input of the Indians in the search for solutions for the region's future. Their contribution to a future based on experience, for the development of sustainable farm production systems, the management of hydrobiological resources and wildlife, and information about useful plants and animals, is highly relevant. Foreign societies and the countries of the basin should therefore seek ways to instill respect for the complex experience acquired by these peoples, attempting to see that such lore is passed on and not scorned, as has been the case up to now. Concrete measures ought to be taken to transfer this knowledge from the native peoples to Western society, since one of the great lacunae is precisely in understanding the way human populations function and adapt in the tropics. The recruitment of individuals of Amerindian origin for positions in government institutions could be one way to transfer knowledge and experience, especially in arriving at decisions which involve the interests of these peoples and the management of biotic resources.

Hydrobiological resources for the supply of fish and timberland to harvest the products of biodiversity for food, or for medicinal, industrial, or artisanal use can be managed efficiently by the indigenous peoples as well as by the extractivists. Their services could also be used to manage and control protected areas. This would not only provide the state with savings of financial and human resources, but would also ensure the application of Indian lore in conserving the country's natural heritage.

Accordingly, laws must address the entire issue of community ownership of land, forests and water resources, making the rights of indigenous peoples and extractivists to their ancestral holdings and the land they now occupy imprescriptible, inalienable, and not attachable. At the same time, legal mechanisms should also be established to avoid the divisive effect which the borders between countries in the basin have had on the Amerindian tribes.

In certain cases an attempt should be made to reconstitute the Indian territories, which settlement processes have reduced to the point where rational management of resources and survival of human groups are no longer possible. To do so, the areas abandoned by the settlers, the areas earmarked for settlements but unoccupied, and the areas expropriated by the state would have to be returned to the tribal peoples. In addition to the areas deeded to the communities as noted above, management and protected areas should be set up as preserves directly administered by the local populations.

Proper utilization of the natural resources will require the following measures: (i) granting of the exclusive right to exploit gold deposits located underneath and in the immediate vicinity of the territories deeded to the indigenous peoples; (ii) establishment of mechanisms to compensate indigenous peoples for the damages caused them by the exploitation of hydrocarbons and large-scale mining in their lands; (iii) compulsory participation of Indian tribes in the planning of mining, in order to avoid encroachment on their sacred places or sites of great ancestral significance; (iv) enlisting assistance from the Indians in the execution of infrastructure works, not only to ensure that they reap the economic benefits thereof but also so that these works are carried out with due respect for the conditions proposed by those peoples themselves; (v) granting exclusive rights to the Indian tribes and extractivists for the exploitation of renewable natural resources within their legally recognized territories; (vi) training of professionals in the natural and social sciences to conduct research on ethnobiological problems; (vii) including assessment of the agronomic factor of ethnobiological components as a routine part of research; and (viii) emphasizing consideration of opportunities for using native plants and animals in development projects conducted in the region.

6.5 New Economic Strategies for Amazonian Development

Amazonia should never again be considered a domestic colony. This region is entitled to its own development process, aimed primarily at improving the qual-

BILINGUAL EDUCATION OF THE SHUAR PEOPLES, ECUADOR

The Shuar and the Achuar peoples have lived in the Ecuadoran Amazon for hundreds of years. They belong to the same linguistic family, and their cultures are similar. The Interprovincial Federation of Shuar-Achuar Centers unites the endeavors of an American Indian group that wishes to survive and maintain its place in society despite adverse environmental conditions. To do so, it has formed this association for promotion of human resources and the integrated community development of its members. The Federation's basic objectives are recognition of the Achuar culture as a constituent element of a pluralistic Ecuadoran state and achievement of economic self-sufficiency as the basis for development, free from outside pressure and influences.

Many pressing problems of a geographic, sociological, cultural and educational nature have prevented the development of school systems in this group. The Shuar Radio Education System (SERBISH) was created to solve the problem of Shuar schooling, with the following objectives: i) to provide children, young people and adults with an education within the national framework that fosters development of the local culture; ii) focus Shuar efforts on development of a group based on self-help and mutual assistance; iii) cultural revitalization; iv) eradication of illiteracy; v) school attendance for the population 6 to 15 years of age; and vi) a firm guarantee of the permanence of communities in the geographic areas they now inhabit.

SERBISH began to operate on October 1, 1972, and was granted official status by Supreme Decree 1160 in 1977. Today its radio broadcasts are beamed at the five Amazon provinces of Ecuador, where they are heard by more than 7,000 students at 187 primary schools and 39 parallel basic secondary schools.

The method employed by SERBISH can be characterized as ideal for the people to whom it is directed. It is based on current realities that take into account the autochthonous growth, interests, aptitudes, and knowledge of the Shuar people. To facilitate quick comprehension, it uses the local language in a conversational manner, relating the words to Spanish for acquisition of the dominant culture's terminology and then translating the new words into the native tongue. The use of an essentially bicultural educational approach throughout the formative curriculum, rather than in an ancillary or limited manner, is aimed at a development style consistent with the local culture.

Recourse to the system of radio broadcasts was chosen as a response to the urgent need for all children to attend school before the problem of adult illiteracy worsens, and in view of the geographic configuration of the Amazon and the lack of infrastructure. This modality has an active multiplier potential and reaches the most remote and smallest groups; it is unifying and it is innovative.

We cannot mortgage the future. God created the world knowing full well how to manage it despite the frailties of human free will. Much sacrifice has paved the road that lies before us. Many of our brothers who had strayed have returned to find that the Shuar family has confidence in the future. Other indigenous groups have also found brotherhood, understanding of their problems, and effective help with us. All of these factors encourage us to continue our efforts.

Miguel Puwainchir W.
President of the Interprovincial Federation of Shuar-Achuar Centers

ity of life for its present and future inhabitants. Many factors will have to be taken into account for this purpose, and some of them are discussed in the following paragraphs, with emphasis on the economic criteria to be applied. First, however, we must underscore the fact that, one way or another, all political decisions adopted by each country will affect Amazonia. Such decisions should therefore be carefully evaluated in terms of their possible repercussions on the delicate balance of that region. At the same time, the fate of the Amazon is inseparable from that of the rest of the country, especially that of the regions whose surplus populations migrate to Amazonia in the hope of building a future there. As a result, the solution to the region's problems is often found outside Amazonia and may lie, for example, in massive investment to develop the Andean region or Brazil's Northeast.

We must prevent public policies for Amazonian development from unintentionally encouraging and promoting high execution costs and low economic yield coupled with far-reaching environmental impact—in other words, failing to seek the proper balance between the alternatives of use and nonuse, with adverse social consequences. The countries' financial efforts, if the goal is to finance infrastructure for settling the region, must carefully avoid directly or indirectly subsidizing extractive activities that pillage resources without regard for the ecosystem's productivity and the high environmental cost. Complex systems of loans and subsidies have ended up producing vast areas of farming, ranching, and lumbering activities without any real estimates of the return on the financial input.

Unfortunately, no subsidies have been offered thus far for conservation of renewable natural resources, much less for sustainable management thereof. On the contrary, those subsidies are explicitly designed to expand the farm and economic frontier through wholesale changes in the original ecosystems. The situation in Peru, Ecuador and Bolivia is very similar to that in Brazil. No incentives are offered for the best technologies for integrated and sustainable use of natural resources, or for the conservation thereof to obtain maximum economic benefits; they are given only for the development of technologies introduced from outside. In the future, the countries of the region should consider possible incentives for sustainable management of renewable natural resources, including the scientific and technological research and extension work necessary for that purpose.

In most cases, the economic analysis to determine the result of a given project is conducted after its execution is complete, and does not address the resources wasted or eroded, the cost of replacing them, or the negative cost of certain practices which cause serious damage, for example to the highway and urban infrastructure and to human life. As a result, the same projects are replicated with the same errors, inevitably producing the same failures. This is another lesson that should be carefully borne in mind in the future, and one that would be unnecessary if each new economic policy or investment were subjected to a thorough environmental impact assessment.

As a result of this one-sided view of project benefits and the secondary negative effect of many incentives, the countries are paying a high price in the form of funds lost or not recovered, cost overruns, and the expense entailed by lack of foresight and improvisation. Suffice it to point to the example of the costs generated nationally and internationally by the cultivation of coca and production of cocaine. A number of countries that produce the coca leaf (Peru and Bolivia) or manufacture and market cocaine (Colombia), as well as its consumers, are faced with extra expenses for crop substitution, the campaign against drug trafficking, and the control of consumption, in addition to the social and ecological costs incurred by the use of the drug itself.

All too frequently, the price paid for lack of planning or inaction, plus the secondary costs of deteriorated resources and social costs, far outweigh the benefits obtained. Such is the case of beef production based on incentives and the production of fish and game without incentives. The ratio of direct and indirect costs to sustainable benefits is considerably greater in the latter, and is thus less advisable. The production of chestnuts or Brazil nuts without destroying forests, versus the production of beef, razing the forests, presents another example. A wide array of options is available for evaluating the economy of development models without destroying ecosystems and with minimal impact on the environment. The selection includes traditional methods, such as extractivism, as well as modern ones, such as ecotourism. Similarly, just as in the past sources of financing were found for high-impact models, today new funding can be mobilized or external debt canceled in exchange for environmental models. The countries have not given sufficient thought to the new possibilities available in this area. Entire development programs can now attract substantial international aid—especially if they benefit indigenous peoples, the resources of biodiversity, ecotourism, sustainable management of resources by extractivists, the management of hydrobiological resources, and restoration of deforested areas, among other targets. These models have a favorable economic impact because of the high rate of return and low inputs. Their social impact is welcome, given the benefits accruing directly to the local populations, and their environmental impact is positive, since they conserve natural resources without impeding the use thereof.

Sustainable development of the Amazon, harmonizing growth with low adverse environmental impact, entails costs which must perforce be defrayed in three important areas: research, control, and recovery of deteriorated resources. Research is essential to provide a better knowledge of the region and objective information for appropriate decision-making. There is little point in assuming that solutions for sustainable development of the Amazon are going to come from other latitudes, such as the temperate zones; far better for them to be generated within the region itself. We have already had experience with imported solutions that fail to do the job. This type of research must be comprehensive and it must encompass the most important variables, such as technologies.

Surveillance, monitoring and control of natural resources and areas earmarked for the various resource management options constitute another unavoidable investment, inherent in the basin countries' jurisdiction over their respective territories. Such control has failed in the past for a number of reasons, among them the lack of land-use planning and the establishment of spatial resource management options. The disarray spawned by the occupation of space, achieved at times through violence, has prevailed over rational order.

The third unavoidable expense is for recovery of areas that have already been tapped, where there is a palpable deterioration of certain resources. These costs can be reconciled with the environmental services that would be produced (the trapping of carbon dioxide, jobs for the inhabitants, reduction of pressure on untapped areas, etc.) and the possibilities of debt swaps for environmentally beneficial activities, among other options.

6.6 Land-use Management and Planning

Countless plans and programs have been devised in Latin America, many of them focusing on the Amazon. Almost all of them lack a fundamental input: participation in the design and approval of such plans by the people affected. Virtually all of these projects have failed, simply because the plans were not respected and applied in the time frame scheduled—largely due to that same lack of grassroots support. None of this invalidates the importance of planning, which deserves to be reemphasized and resumed with new fervor, i.e., with the added vigor provided by the parties interested in the design for their own future. Without planning, the Amazon will have no future. Planning has various dimensions, and the nature of the broadest parameters is well known. That is why this document emphasizes a planning tool which is well known in Europe but thus far has seen little application in the Amazon: land-use planning.

The main challenge for development of the Amazon is to make expansion of the economic frontier compatible with ecological conservation. To do so, some essential features of the region must be kept in mind, including its continental dimension and its importance as the economic frontier for agriculture, energy, mining, and forestry. This requirement is frequently overlooked in policy recommendations, either from a broadly international standpoint or in terms of sectoral, regional or ecological interests (Fearnside, 1988; Repetto, 1988).

Hence it is important to develop strategies that are capable of generating sustainable development without ecological destruction in the region. Here there are several options. The first is definition of the different types of economic activity that should be developed in the various parts of Amazonia. Since the purpose of a coherent conservationist policy is to ensure continuous utilization of useful plants, animals and timber by means of cycles of harvesting and renewal, the goals of a forestry policy for the region should perforce be to: (i) keep climatic changes stable; (ii) conserve the sources of fresh water supply; (iii) protect the soils from erosion; (iv) control floods by maintaining the hydrological cycles; (v) protect flora and fauna resources, particularly rare species threatened with extinction; (vi) make economic use of wood and other plant and animal resources; (vii) provide mankind with opportunities for action and cultural and scientific improvement; and (viii) protect the ecosystems of the peoples who inhabit the region (Gama and Silva, 1987).

To attain these objectives, land-use planning based on ecological and economic criteria which take into account the realities of nature—especially the ecosystems and soils existing in the region, plus the present use of land and the specific interests of the inhabitants—is of paramount importance. The use of each ecosystem should be subject to specific, ecologically appropriate standards. For purposes of sustained development, land-use planning based on the different possibilities of the individual ecosystem is essential. A basic priority is to guarantee the continuity of evolutionary processes by conserving the genetic diversity of forest species.

Land-use planning is first of all a truly ongoing process whose initial phase can take a relatively long time (Dourojeanni, 1990). The first step is the preparation of topical maps, where overlays showing the potential use of land are placed on the map showing present use. A first and purely theoretical proposed use can then be drafted—one that is purely theoretical but nevertheless permits the establishment of compromises to resolve the most obvious conflicts in land use. In reality, this stage consists of producing a map which demarcates zones for the use of natural resources.

The second stage calls for the devising of land use strategies for each particular area. The usual procedure followed recently in Brazil is to delimit zones for the following purposes: (i) annual and/or intensive agricultural development; (ii) intensive or extensive stockraising; (iii) agroforestry and/or perennial crops; (iv) forestry development in places where reforestation or rehabilitation, if needed, and forestry management are scheduled; (v) indigenous territories; and (vi) environmental protection preserves. These zones are established in accordance with the needs of other activities, such as mining, oil exploration, and energy which can overlap in some cases, or fishery, hunting and ecotourism, among others. That second stage does not necessarily include the participation of local inhabitants since up to this point a technical proposal is involved, although it may be better understood to constitute a social proposal.

The third stage consists of preparing sustainable development strategies for each zone thus defined, based on present reality. The planning must project the outlays for infrastructure that will be needed in each zone, in particular the economic strategies to be applied so that the corresponding land-use is encouraged and not imposed. As is well known, land-use planning cannot be imposed by means of force, or with the help of border guards, for example. People should be motivated by education, conviction and incentives to adopt the development style embodying the natural vocation of each zone.

The foregoing three stages can be covered in a year or two, depending on the scale, the baseline information, and the economic resources available. At the same time—but usually after the third stage is completed—a start can be made on the fourth and decisive stage of land-use planning: the level at which the community takes part in the final decision. The people affected, either directly or indirectly, must be convinced that the options offered by the plan are to their advantage. They must understand and discuss the alternatives and the rationale, and they must be given a chance to amend them in a democratic manner. In addition to meetings, the broadcast and print media should serve as means of consultation and heightened public awareness. In the State of Rondonia, that consultation mechanism allowed its inhabitants to support the policy of discouraging new migrations to the state territory—an event that was unprecedented in the annals of Amazonia.

THE BENI-BOLIVIA BIOLOGICAL STATION

From 1938 until the present, the Bolivian government has enacted a series of legal measures covering 31 protected areas. Three of these are now engaged in consolidation and systemactic development including the biosphere reserve of the Beni Biological Station (BBS).

The process of setting up the reserve made provision for the Chimane indigenous population and the rural communities in the reserve areas to take part in various projects and programs; and, for development purposes, the regional projection and promotion of buffer zones surrounding the 135,000 hectares comprising the BBS.

Substantial progress has been made in five years of systematic work, mainly in the conduct of pure and applied scientific research programs as a basis for an Area Management Plan, and in coordinating the different population sectors involved in the Reserve. The strategy adopted calls for developing rural and indigenous communities through strengthened community organization; support for agricultural and rural projects; improved health care and education programs; and the extension of such programs at the regional level.

The Beni Biological Station was also used as the regional nucleus to foster concentrated economic, technical, institutional, and political efforts to consolidate a macro-area of three million hectares, including the Elsner Espiritu (70,000 ha) and Sabanas entre Espiritu (150,000 ha) estates; BBS (135,000 ha); the Yacuma Regional Park (130,000 ha); Eva-Eva-Mosetenetes (225,000 ha); the National Indigenous Territory Isiboro-Sécure Park (1,100,000 ha); the Pilón Lajas Biosphere Reserve (280,000 ha); the Chimane Indigenous Territory (392,000 ha); the Multiethnic Indigenous Territory (352,000 ha); and a zone for business use (420,000 ha).

All of these areas now enjoy a legal basis. Consolidation of the macro-area was predicated on the belief that development of protected areas where human populations are present cannot succeed without their active participation in the work of conservation and in the search for viable alternatives consistent with the aims of conservation and development.

The final and decisive step in land use planning is one of a legal nature. The provincial, state, regional, or national legislatures must enact appropriate laws that support land-use planning as a guide to occupation of the territory. In addition to approving the plan, those laws must define its scope, duration, and means of execution. Some of the states in the Brazilian Amazon have already approved zoning legislation, and a concerted effort at land-use planning in Legal Amazonia is now under way. At the same time, international development agencies such as the IDB and the IBRD are promoting this type of action in almost all of the Amazon countries as a precondition for the financing of highway or settlement projects.

6.7 Population and Agrarian Justice

If development of the Amazon were conducted in a more prudent manner, it could probably support a larger population than at present without impairing the conservation of the region. The problem with the destruction of Amazonian ecosystems is not overpopulation but disorderly use of the resources and poor distribution of the population—including massive, and frequently unexpected, descent on sites that are not capable of receiving such large numbers of persons in so short a time. Further, as noted earlier, if all of the land already cleared and then abandoned or left practically idle were used for that purpose, the region could easily accommodate a significantly larger number of inhabitants.

The extremely low population density of the Amazon countries makes it unlikely that any neo-Malthusian hypothesis can explain the region's deforestation. Immigration is not a consequence of population pressure: it stems mainly from the extremely concentrated pattern of land tenure in those countries. The data for 1970 show a highly inequitable distribution of land ownership in Amazonia: the classic model of a small number of large properties and a large number of very small properties. The supply of land is thus artificially reduced, thus increasing the pressure on the limited acreage available and spawning serious social problems for the poorest population strata.

The availability of unsettled land, combined with the construction of highways in the 1960s and 70s, was a great incentive for immigration for people who saw the ownership of more land as a possible solution to their poverty. The government promoted settlement and highway construction programs in the region in an attempt to ease the social problems spawned by extreme poverty in the rural areas of Brazil, mainly in the northeast and the south. Accordingly, agrarian reform is needed outside the Amazon region. In addition, part of the economic policy which is not undergoing radical change is the fiscal treatment of activities related to land use and ownership, which have a clearly regressive impact on the distribution of income and wealth. The subsidized credit and fiscal incentives for agriculture are thus capitalized in price of land, and access thereto becomes prohibitive. Consequently, social movement is restricted, leaving rural migration to cities or to the unsettled areas as possible alternatives (Repetto, 1988; Binswanger, 1989).

This situation evokes a certain amount of skepticism, since it suggests that the definitive key to sustainable development in the Amazon hinges on government initiatives far more sweeping than those specifically aimed at resource conservation or at Amazonia as an isolated problem. It is also obvious that the solution will take longer than we had hoped.

We must realize that there are limits to the human load that can be borne by Amazonia, as with any other part of the planet; and that the relatively scant percentage of arable land available there means that its capacity is much smaller than that of other parts of South America, except for the deserts. As a result, this region cannot be expected to absorb large population groups from the countries—a constraint which must be clearly understood and included in national strategies, plans, and policies. Given all of these factors, the Amazon countries should (i) devise appropriate general population policies to prevent unbridled demographic growth; (ii) oversee and moderate migration to the region; and (iii) stem the rural exodus to Amazonian cities.

To control unrestrained migration to the Amazon, present colonization policies will have to be adjusted and replaced, on the one hand by proper land-use planning and on the other by attention to social and economic problems in the depressed peripheral areas. As explained earlier, the settlers come to Amazonia from other regions due to poverty, the lack of opportunities, social conflicts, and the like. They are also attracted by the opening up of highways and by government programs. In general, it is highly recommendable to reduce these migratory flows—or at least slow them over a period of time, since at present they defy all efforts to sensibly coordinate occupation of the Amazon. Emergency measures are needed for that purpose. One that is important is the achievement of a more equitable distribution of land in the depressed peripheral zones to keep colonists in their place of origin and control migration to the Amazon. It is also essential to promote new investment in the regions where the migratory flows originate so as to improve the employment situation there. At the same time, the state incentives fostering migration to the region must be withdrawn.

For the populations already installed, steps will have to be taken to stabilize the colonization fronts through land-use planning and heightened agricultural productivity in the areas already affected. This calls for training programs and education for the settlers to help them adjust to Amazonian environmental conditions and coordinated utilization of the available resources, thus enabling them to graduate from the status of uprooted groups to inhabitants of the Amazon, integrated into the environment in sustainable fashion. To that end, living conditions and education, health and communications services will have to be improved and there must be a change of attitude on the part of non-Amazonian society that will allow the settlers to be considered respectable citizens rather than destructive human beings.

Exploitation of the region's mining potential, if properly planned, could cause less direct damage than at present. The big problem would seem to be not mining itself, but primarily the urban infrastructure surrounding the mining development poles and the places that produce goods and services for their use. Based on the principal mining production areas in the Amazon and the development of tree felling depicted in satellite images, the mining sector is seen to deforest an average 0.017 square kilometers for every million dollars it produces. Ranching deforests 100 square kilometers (Santos and Riker, 1989) to produce the same amount. Development of the Amazon by using its mineral deposits—taking care to avoid ancillary activities that promote deforestation, such as agriculture and stockraising—is therefore one of the region's best development options. A series of measures will have to be adopted for this purpose. Chief among them are: (i) centralization of the gold trade in a government agency; (ii) recognition of mineral discovery rights, including those of the individual prospector, with mining titles issued by official agencies; (iii) enactment of specific legislation on mining in respect to conservation, extractivism, and Indian territories; (iv) reformulation of the regional system of teaching, introducing notions of geology and mineralogy from the start of the school years and stressing university courses in geology and mining engineering in the Amazon; (v) allocation of any resources from taxes on mining to the region; and (vi) emphasizing of bilateral trade in minerals with the countries of the region, reducing imports of minerals from distant countries and gradually replacing that source. In this case, it is vitally important to keep the existence of mining centers from attracting a large influx of population, which leads to deforestation.

In the specific instance of the *garimpo* phenomenon, the disorganized exploitation of gold and precious stones is the main cause of environmental deterioration, as well as the subhuman and unsafe conditions in which prospectors work. Very concrete action should be adopted in the future to organize gold prospecting and lessen its adverse social and environmental impact. Generally speaking, the most desirable measures other than those cited above are land use planning; the establishment of mining reserves; registry and license requirements; technical assistance in the recovery of mercury; organization of small extractor units into companies; the use of techniques to rehabilitate devastated areas; the generation of other profitable alternatives; delineation of off-limits areas; establishment of education, health care, and training services; and improvement of dialogue and cooperation between official agencies and gold prospectors.

Many of the economic activities on which Amazonian cities—particularly the medium and small-sized ones—depend for a living are of a rural nature. The growing migration from rural Amazonian areas to cities in the basin is also depleting the rural population and contributing to disorderly urban growth. This is one of the reasons underlying the chronic inattention to rural areas and for the illusion, generated by textbooks and the mass media, that better opportunities are to be found in the cities. Unfortunately, urban growth is not accompanied by parallel increases in housing, sanitation, education, health care services or employment. Existing services are inadequate and the chaotic urban growth pattern is a source of social conflict and poverty. Under the circumstances, it is imperative for the governments in the basin to provide suitable infrastructure for rural education, health care, and communications facilities to help stem the migration towards the cities. At the same time, living conditions for the inhabitants of small and medium-sized cities in the Amazon must be improved by preparing urban housing, infrastructure, and services and creating opportunities for earnings. Vigorous efforts must be made to provide jobs in order to combat slums and poverty, while providing rural zones with services as a means of controlling emigration.

The Amazonian countries must see to the well-being of their populations by assigning high priority to programs for the improvement of social services and communications infrastructure. The key areas are the following: (i) improvement of river communications, strengthening the port infrastructure as a complement to existing means and making use of the region's natural waterways; (ii) upgraded radio and telephone communications with the use of modern systems based on nonconventional energy; (iii) improved environmental health infrastructure in both rural and urban areas; and (iv) better education, health care, housing, and energy services throughout the region, with special emphasis on housing in Amazonia.

6.8 Education, Science and Technology for the Amazon

The scientific and technological foundations for Amazonian development are being laid through institutional and individual efforts. Despite such efforts, those foundations do not suffice for the establishment of a regional policy on sustainable development. Special consideration must be afforded countries with weak human, institutional and technological infrastructure, such as Guyana and Suriname. Three factors are crucial: (i) the scarcity of regional programs for the concentration of efforts; (ii) the scarcity of skilled human resources; and (iii) the shortage of suitable levels of financing.

The countries have unquestionably made some progress. Brazil, for example, set up Tropical Wetlands Programs in 1972 so as to "coordinate the contributions of science and technology to a better understanding of the conditions in which human beings adopt to the peculiarities of the humid tropics and to the preservation of the ecological balance of the Amazon region." Similarly, it established the Northern Graduate Projects, the Regional Amazonian Research Coordinating Committee (in 1989) and the Subprogram for Technical and Scientific Support to the Pilot Program on Conservation of Brazil's Tropical Forests.

For the future, the Amazon will need a permanent system for the evaluation and development of knowledge which will provide feedback on planning for sustainable development. The fragility of the scientific resources and technological instruments currently available—which is clearly manifest in the reduced capacity of existing data banks and limited reliability of statistics in the region—must be recognized. The virtual absence of resources in science and technology calls for an immediate improvement in the scientific and technological ability to permit a more accurate evaluation and knowledge of the region.

The establishment and consolidation of scientific and technological foundations must be geared to present and future demand in terms of the following priorities: (i) establishment of a suitable environmental policy; (ii) creation and maintenance of regional competence; (iii) establishment of orderly ecological and economic planning for the region; (iv) recovery of indigenous and popular teachings; (v) a summary of the scientific knowledge available; (vi) development of new scientific premises; (vii) conservation of biodiversity and development of its potential; and (viii) attainment of economic development and societal well-being.

Accomplishment of these objectives entails a series of strategic measures designed to support and consolidate centers of excellence, which in turn call for promoting a linkage between universities and other research centers and the productive sectors; consolidation of graduate institutions and programs in areas dedicated to development; establishment of a system of scientific and technological information in the region; implementation of a system for managing Amazonian water resources and the resulting hydrological projects; and development of a computerized system of territorial management for comprehensive planning of the region's natural resources.

Another requirement will be to promote a science and technology program for the region. Formulation of such a program entails coordination of scientific and technological activities in Amazonia; planning and perfecting existing technologies; the generation of new local technologies; the adaptation of new technologies for the promotion of development; and enhanced productivity and quality of regional products. Support for research projects is also needed. Research policy must focus on priority areas, such as the environment and natural resources; human populations; Amazon health care and nosology; agricultural production systems; coordinated forestry management; the economy; and appropriate technologies. Priority must be assigned to helping the region's young scientists conduct applied research in the priority areas. The training of human resources is essential.

Attainment of those goals calls for designing an education system consistent with Amazonian reality that can teach the inhabitants how to use resources properly. This new educational approach should encompass all levels and focus on solving the region's most pressing problems (Hebette, 1983). The lines of action should be aimed at expanding graduate support programs; retaining skilled personnel in the region's institutions by offering them various incentives, such as funding for research and regional scientific development, salaries based on qualifications, laboratory infrastructure, technical and administrative support, and continuing education in centers outside the region, among others.

A regional science and technology network will also have to be set up. Information about Amazonia that is vitally needed by researchers, those responsible for national and regional decision-making, and Amazonian institutions is available: not in the region, however, but elsewhere, and mainly in the developed countries. Most Amazonian institutions were founded quite recently and have not yet been able to generate and accumulate data about the region. Overseas scientific agencies, on the other hand, have built up a valuable store of information in the form of scientific collections, studies, and publications issued over the course of various centuries of scientific and anthropological expeditions. UNAMAZ and SIAMAZ in Amazonia and INFORMAM in Brazil represent progress which must be strengthened.

Present-day duplication, photocopying and communications techniques will allow the repatriation of such information and facilitate the establishment of information and documentation centers in the respective countries and at the regional level. Such centers would provide Amazonian researchers and professionals with access to valuable information which they could otherwise obtain only with considerable difficulty and at a high cost. Official and private international institutions could be extremely helpful in supporting the repatriation of information and the founding of documentation and information centers for the region, thereby helping to improve the regional and local decision-making process.

Finally, adequate funding for research and technological development must be made available. The endowment of scientific and technological research funds for local researchers could be part of this service to the region and its inhabitants. Along the same lines, it is imperative to secure financing to supply the region with suitable infrastructure, for example: the installation, maintenance, and restoration of laboratories; computers; communications systems; the organization of reference collections (herbariums, museums); and the creation, improvement and maintenance of libraries and archives, among other items.

SCIENCE AND CONSERVATION IN GUYANA

In an effort to share global responsibility for coping with the loss of tropical forests, the government of Guyana is currently carrying out two very important projects to learn more about biodiversity and preserve forests in this Amazon-fringe country. In the words of Jane C. MacKnight, an officer of the WWF program there, "Guyana is one of the few tropical countries in the world where conservation can be an integral part of the nation's development planning."

One of the goals is to define and implement the plan for management of the Kaieteur National Park in the center of th country. The project calls for expanding the present area set up to safeguard its principal scenic asset—the waterfalls of the same name, five times as high as Niagara—and include another preserve of at least 45,000 hectares for long-term management of its biological riches. The native flora is three times as diverse as that of the entire United States; in addition there is a wealth of fauna, particularly birds. An estimated 20 per cent of the region's 500 species of orchids cannot be found anywhere else in the world. The boundaries of the park were carefully drawn in such a way as to include all elements of the region's ecological heterogeneity, a *sine qua non* for maintaining its long-term ecological integrity. Plans also call for the development of infrastructure and special tourism programs in keeping with the nature of the preserve, along with management for the benefit of the five indigenous communities that have settled in the area selected.

The second project of special importance in Guyana is establishment of a center, headquartered in the University of Guyana, to study the biological diversity of the Guianas with the collaboration of the United States' Smithsonian Institution and grants from the Royal Bank of Canada. The center will compile and store information and biological collections from the region, and will provide training and advanced studies for students of natural sciences and education.

Vicki Funk, Director of the Guyana Program at the Smithsonian, says: "This joint undertaking will cement our relations and enhance the urgently needed scientific research throughout the region, allowing research and conservation to go hand-in-hand."

6.9 New Institutions for the Amazon

The march of time is propelling Latin America from statism to a regime of greater economic liberalism, bringing unquestionable advantages. But these policies could be pushed to extremes, depriving the state of all leadership potential. We must remember that the state apparatus in Amazonian countries has already been severely damaged by a decade of economic stagnation experienced throughout the entire region. Amazonian institutions suffered even more than the rest since most of them were barely established when the economic crisis broke out. Environmental concerns cannot be subject to market forces, nor will sustainable development for the Amazon be achieved if those forces prevail. Vigorous state intervention and strengthened planning and institutions are essential

ASSOCIATION OF AMAZON UNIVERSITIES (UNAMAZ)

UNAMAZ was founded on September 18, 1987, the fruit of recommendations made by scientists, teachers, and researchers in the TCA member countries. The basic purpose underlying its establishment was to provide a catalyst for isolated efforts to promote the production of relevant knowledge for sustainable development of the region; to stimulate development and implementation of higher education and research institutions in Amazonia; and to foster the increase and enhanced quality of the region's human resources.

With its 18 founders, UNAMAZ today includes 57 training and research centers, universities, higher education and research institutes in both the public and private sectors.

The Association's activities are carried out under the aegis of the Amazon Inter-University Cooperation Program (PROGRAMAZ), which covers six basic fields of action: (i) education and cooperation for development; (ii) science and technology; (iii) the environment; (iv) human settlements; (v) culture and development; and (vi) information and documentation.

UNAMAZ is currently engaged in a number of projects. One of the most important is implementation of the Amazon Information System (SIAMAZ), which links agencies responsible for scientific and technological output concerning Amazonia in a vast network encompassing the region's eight countries. Other activities now in progress include a project for the benefit of the children of the entire region, and a program of higher education and Amazonian development.

for the development of this vast region; far-reaching changes will be needed to make the Amazonian countries more efficient and participatory.

Amazonia needs to have its own efficient institutions to guarantee sustainable development, given its potential and limitations. Amazonian institutions, for the Amazon, should be attuned to local reality; they must seek solutions that are appropriate for the region, in which the population plays a part, so as to permit the input of successful experience and decision-making at the local level.

Noteworthy efforts have been put forth in the countries by institutions responsible for research and evaluation and control of the region's natural resources. The lack of continuity of such efforts and, to a degree, the lack of consistency with the region's reality are common problems. Guidelines often fail to take local conditions into account, and many of the institutions are either located outside the region or else the policies they carry out conform to other realities.

The new Amazonian institutions must assume the following duties: (i) channel available resources, which at present are being used in scattered and disorderly fashion; (ii) design policies, strategies, and long-term development programs in light of Amazonia's needs; (iii) reconcile the interests of the region's different human groups by means of compatible, coordinated, and complementary development proposals; (iv) advise central governments on the way to develop the region; (v) ensure direct participation of the inhabitants through the grassroots organizations, whose representatives should be included in the boards of directors; and (vi) ensure research on and the monitoring and control of the region's natural resources and environment.

Strengthening of the Amazon Cooperation Treaty must be a top priority for the Amazon countries and the international community as a valid mediator in a joint effort of the countries in the basin. Its coordinating and promotional role is vital.

Particular emphasis should be placed on the grassroots institutions of the inhabitants themselves, for they represent the democratic and participatory essence of the Amazon region. The growing problem of competition among both national and international nongovernmental organizations that have little contact with the colonists should be the object of careful scrutiny by those agencies themselves. This should by no means detract from the importance of their contribution, which is very great indeed and is expected to become even larger in the future. But they themselves will have to examine the role they play and assess the democratic nature thereof.

Much higher priority should be placed on Amazonia by the international financial and technical cooperation organizations. With few exceptions, it is only in the past decade that those agencies have started to address the issue of Amazonia's environment. Since the subject of the environment and Amazonia became fashionable, the Amazon countries have witnessed a renewed and somewhat unproductive rivalry between such organizations: the spate of rhetoric is in disturbing contrast to the dearth of concrete action in dealing with this issue. Any duplication of efforts in their activities must at all costs be avoided, and they should be required to play a more important role in publicizing and solving the problems of the region.

6.10 Abandon the "Law of the Jungle"

The present judicial system of the different Amazon countries was designed to address realities other than those of Amazonia, and its norms are largely inapplicable to the region's environmental, social, economic, and technological requirements. The classic example is found in the closed seasons for hunting and fishing, which are based on the needs of other regions, where the capital cities and legislators are situated. The national legal codes should therefore be expanded and adjusted to reflect Amazon reality.

But the failure to reflect reality is not the central issue. The most serious problem confronting Amazonia is that the laws are not obeyed, irrespective of their adjustment to reality. At times they are not even obeyed by the very authorities responsible for ensuring such obedience. The reasons for this situation are, first of all, the institutional weakness of public administration, as cited in the previous chapters. Second, but no less important, is the unrealistic way many laws are drafted. In the battle between what is judicially ideal and what is pragmatically possible, the ideal always wins. But laws the enforcement of which obviously costs money are useless without a budget for that purpose. All of these factors create widespread confusion and a systematic lack of confidence in the written statutes. People assume, not without cause, that the letter of the law is a dead one except when it serves their own interests and when the necessary backup is available to enforce it. In the end, legislation only helps to consolidate private interests, by neglecting social concerns—precisely the reverse of the reason which leads society to promulgate laws.

Accordingly, a far-reaching revision of the legal mechanisms that consolidate Amazonian development strategies is necessary. Every last vestige of legal phraseology must be scrutinized. Existing legislation on Indian settlements, forestry resources, wildlife, fishery, conservation units, grassroots participation, and many other issues must be reexamined and redesigned in the light of past results. The law should be simplified and made more direct, and it should provide incentives such that the public will abide by it, to

BRAZIL: NEW ENVIRONMENTAL POLICIES

Recent years have seen radical changes in Brazil's environmental policies, particularly those having an indirect impact on the environment. The most important is undoubtedly the constitutional reform of 1988, which introduced chapters on both the environment and the rights of indigenous peoples. Particular reference is made to the need to safeguard ecological processes, environmental equilibrium, and the quality of life of its population, and to protect Amazonia as a "national heritage."

Various laws and institutional changes since 1987 have reduced the incentives for deforestation of the Amazon. A case in point is suspension of the POLAMAZONIA program, which offered substantial incentives for the expansion of agriculture—especially stockraising—and for mining and industry in the region. The process was instituted with the Our Nature Program, which founded the National Environmental Fund (FNMA), among other activities. The National Environmental Institute (IBAMA) was created to merge most of the agencies previously involved with environmental concerns and natural resources. IBAMA was later placed under the authority of an Environmental Secretariat (SEMAM) which reports directly to the Presidency of the Republic. In addition, Brazil has arranged for a substantial loan to finance these reforms, thereby inaugurating the National Environmental Program (PNMA), largely devoted to Amazonia.

Several noteworthy economic measures have helped to relieve the pressure on Amazonian resources. They include the following:

- Decree 101 and Decree 153, which prohibit fiscal incentives for projects entailing deforestation in primary forests and primary ecosystems, and require projects to be consistent with ecological zoning that has been completed or is in progress, and to be examined by competent environmental agencies.
- Projects featuring fiscal incentives must be approved in advance by SEMAM, IBAMA, the National Indigenous Foundation (FUNAI), state environmental organizations (OEMAs), the Secretariat of Strategic Affairs (SAE), and the National Institute for Agrarian Reform (INCRA).
- Financial terms are less favorable now for projects that are not implemented, since loans are granted only when SUDAM (the Superintendency of Amazonian Development) confirms that the project's operational phase has been completed. The ceiling amount for loans is 50 per cent of the project cost. SUDAM favors enclosed planted areas for agriculture and livestock projects.

Planning for the development of infrastructure has also been limited, mainly due to cutbacks in public financing. At the same time, new programs for energy generation and highway construction are subject to licensing by a federal or state agency, and they are required to include an environmental inventory and an evaluation of environmental impact.

Source: "Update of Relevant Brazilian Policies," World Bank CEC Technical Mission to Brazil, 1991.

which end the public should always be consulted. Finally, the law itself should contain the mechanisms that will enable it to be obeyed, monitored, evaluated, and controlled. A law that is not respected represents the worst possible service to society. The law of the jungle cannot be allowed to continue to prevail.

6.11 Conserve Biodiversity

The genetic legacy contained in the Amazonian ecosystem is the best example of a public good supplied by tropical forests, and its worth is probably incalculable. Despite the lack of precise scientific knowledge, it is estimated that the contents of Amazon tropical forest biota range from 800,000 to five million species, thus accounting for 15 to 30 per cent of the total number found in the biosphere (Schubart, 1989). Roughly 90,000 of the 250,000 species of major plants catalogued are located in tropical areas of Latin America and the Caribbean, far exceeding Africa's 30,000 and Asia's 35,000. Even more impressive is the fact that a plot of ground measuring 0.2 hectares (less than half an acre) near Manaus contains 505 species of trees more than two and a half meters high, as compared with fewer than 50 species in the whole of France. Similarly, more than 2,000 species of fish are found in the Amazon River—eight times the number in the Mississippi River and ten times the total in all of the rivers of Europe combined.

To conserve representative samples of the ecosystems and biodiversity of Amazonia, the countries have set up one of the world's most important protected areas. Despite such efforts, as noted earlier, there is still room for improvement. Three problems in particular beset this system, designed to be the corner-

THE INDIGENOUS PEOPLES IN THE NEW CONSTITUTION OF COLOMBIA

The newest constitution in Latin America has fully recognized the rights of the indigenous communities to collective and private ownership of land as a type of indigenous buffer zone and has established the legal basis for their operation as politico-administrative units. Issues addressed include the following:

- The State recognizes and protects the ethnic and cultural diversity of the Colombian Nation.
- The State and its inhabitants are obligated to protect the cultural and natural wealth of the Nation.
- The State will protect and promote associative and common forms of property.
- Property of public use, the natural parks, the communal lands of ethnic groups, the lands used as buffer zones, the archaeological inheritance of the Nation, and other property as determined by law, are inalienable and unattachable.
- Members of ethnic groups will have the right to an education which respects and develops their cultural identity.
- Culture in its diverse manifestations is the keystone of nationality. The State recognizes the equality and dignity of all cultures that help form the country.
- The cultural patrimony of the Nation is under the protection of the State. The archaeological patrimony and other cultural assets which comprise the national identity belong to the Nation and are inalienable, unattachable and inviolable. The law will establish the mechanisms to reacquire them when they are found to be in the hands of private parties and will establish special rights for ethnic groups occupying territories containing archaeological treasures.
- Indigenous authorities will be empowered to exercise legal functions within their jurisdictions in accordance with their own regulations and procedures, providing they do not violate the Constitution and the laws of the Republic. The law will establish the manner in which this special jurisdiction will be coordinated within the national judicial system.
- The departments, districts, municipalities and the indigenous territories are territorial entities.
- Acting in concert with the National Government, the territorial entities will prepare and adopt development plans to insure the efficient use of their resources and the adequate performance of the functions that may be assigned them by the Constitution and the law.
- A National Planning Board will be established, composed of representatives of the territorial entities and of economic, social, ecological, communitarian and cultural sectors.
- The municipalities will share in the current revenues of the Nation. At the behest of the Government, the law will determine the minimum percentage of that share and will define the priority areas for social investment to be financed with said resources. For the effects of this share, the law will determine the indigenous buffer zones which will be considered as municipalities.
- The law will determine conditions for exploitation of nonrenewable natural resources, as well as the rights of the territorial entities to the same.

The challenge not only for Colombia but for the rest of the countries is principally to understand and apply judicial principles.

stone for conservation of the region's biodiversity: (i) haphazard operations, due in turn to the lack of economic resources and political will; (ii) the absence of participatory mechanisms that would allow the people living near protected areas to play a role in the management thereof; and (iii) the as-yet incomplete status of various preserves to be established in Amazonia, which leaves numerous ecosystems and species without the requisite protection.

Items one and three are a source of internal conflict in management of the systems, for on the one hand it makes little sense to set up any additional conservation units when sufficient resources are not available to administer the existing ones. At the same time, however, if the remaining preserves are not created now, there is little likelihood of their establishment in the future. It is therefore recommended that work continue on the three fronts simultaneously since a preserve on paper is better than none at all. Governments and international cooperation agencies should nevertheless give a great deal more thought to this issue, the economic and social justification for which has been demonstrated thanks to biotechnology, ecotourism, and other uses of natural resources. Up to now, most of the requisite funding for creating and maintaining the national systems of protected areas has been provided by the Amazon countries themselves. Recently, for example, Brazil secured a loan of more than $100 million from the World Bank, most of which will be used to establish and manage conservation units and other nature preserves. Other countries, such as Colombia, are also negotiating loans for this purpose. The generous but modest donations from international nongovernmental organizations cannot compare with the amounts spent by the governments themselves, nor are they adequate, despite the statements sometimes made in international forums.

Although the estimates are not accurate, it is believed that more than 1,000 species of plants in the Amazon ecosystem have economic possibilities, and that at least 300 species of trees are potentially valuable as forestry resources. But most of the estimated value of Amazonia's biodiversity may well be in its contribution as a treasure trove of genetic models for technological innovations in chemistry, pharmacology, medicine, and agriculture (Oldfield, 1981). Progress in biotechnology in turn heightens the probability that a significant number of tropical forest species might be used as genetic models for new pharmaceutical and chemical products, pesticides, medicine, food, and other items. It should be noted in this connection that 25 percent of the drugs prescribed in the United States are of plant origin, and that the market for those drugs amounted to some $8 billion in 1980.

The extinction of species in Amazonia will therefore be a significant loss for all mankind. The forecasts on extinction rates are subject to a wide margin of error. Estimates indicating that10 percent—i.e., about 30,000 in round numbers—of the species in Latin America's tropical forests will be extinct by the year 2000 are nevertheless considered conservative. Many of these species are unknown to science, and the uncertainty inherent to the process of scientific development makes it virtually impossible to place a value on their extinction.

In an attempt to assess the magnitude of these losses, a model is proposed in which the ratio of biological diversity to wooded areas is supposedly equal to the ratio of biodiversity to island areas. This leads to the assumption that if 90 percent of Amazonia is deforested in the next 100 years, approximately 50 percent of the species alive today will be extinct. If scientific knowledge is not acquired before those species disappear, 50 percent of the information they contain will be irretrievably lost.

Control of tree felling is therefore the most effective solution for conservation of Amazonia's biodiversity. It must nevertheless be remembered that, despite the benefits biodiversity conservation holds for all mankind, the share of those benefits accruing to the countries of the basin and the economic agents operating in the basin is insignificant. There are no economic incentives to enlist the interest of those countries or agents in the conservation of biodiversity. The obstacles to the establishment of such incentives are enormous, inasmuch as this kind of knowledge is essentially a general or public good. In any case, a minimal step in that direction would be to try to improve the technological capacity of the countries comprising the Amazon basin so that they derive more of the benefits of the region's genetic heritage. This would have a dual purpose: on the one hand, to direct research efforts to solving the specific problems of the countries and the region; and, on the other, to increase those countries' share of the revenue and royalties produced by technological innovations based on a knowledge of the biodiversity of Amazonia.

It behooves the developed countries and international organizations to expand the basin countries' access to the technical and financial resources they need. This could be accomplished by a technology transfer program backed by the loans required for that purpose. Another form of support to the Amazon countries should be the financing of protected areas as

BIODIVERSITY
"BUY IT: IT'S A PRODUCT OF THE RAIN FOREST"

For those who are not scientists, biodiversity is a new word that covers, among other things, what we have always known simply as flora and fauna. Most of those same "products of biodiversity" currently in the news and previously called secondary forestry products—or, more recently, non-lumber goods—have been exploited and marketed for centuries. Almost all of the Amazon countries used to sell substantial quantities of innumerable items that have now been "rediscovered" to local, regional, or export markets. Hundreds of tons of nuts were used and exported as ivory or Brazil nuts, as well as thousands of tons of resins such as balata and rubber; hundreds of tons of plant extracts such as curare and other species for various medical uses—to say nothing of ornamental plants, fruits, and countless other products. The most valuable items in Amazonia's biodiversity are not new. Quite the contrary: for several centuries now, the entire world has enjoyed the benefits of cultivated plants of Andean-Amazonian or Amazonian origin, some them such important commodities as yucca, avocados, papaya, various annonaceous trees and shrubs, cocoa and, of course rubber, great mullein, and cinchona bark. More than a hundred years ago, agronomists recognized these plants as genetic resources and were always aware of the enormous value of their forest relatives or of local varieties for purposes of genetic improvement. There have been historic cases of illegal removal of genetic material from the region, the most famous being that of rubber (*Hevea brasiliensis*), now cultivated especially in tropical Asia, although its genetic survival continues to depend on the Amazon.

Yesterday as today, it is the indigenous peoples and other inhabitants of the forests who have extracted these goods. In many instances the extraction was abusive because of soaring demand. Resin extractors bled trees to death or cut them down to get as much as they could in a single operation. Those who gathered medicinal and ornamental plants uprooted vast areas, and the collectors of fruits and nuts often severely impaired the species' regeneration capacity. It is nevertheless true that plant extractivism, like selective exploitation of timber, has a less drastic effect than agriculture or ranching, since it allows the ecosystem to survive. It is for that reason that the rediscovery of extractivism offers conservationists an interesting strategic option.

Today, various nongovernmental organizations conduct marketing programs for non-lumber products as a means of helping indigenous groups residing in fragile ecosystems to change their traditional ways of managing resources and generate income by processing and selling the products. These initiatives, coupled with the mounting concern of the developed world over the problem of deforestation, have generated a potential for the "Green Market." There are countless instances of sales for the products of biodiversity, which are in great demand because they are natural and appear to be the result of ecologically sustainable projects managed directly by indigenous communities. The secrets of the tribal peoples have not yet been retrieved to the extent of producing a profit for the shareholders. Only a small percentage of such revenue returns to the countries of the South in the form of donations to non-profit agencies. As explained in other chapters of this report, however, the volume of world trade in the products of biodiversity is very important indeed. An idea of its size may be gained from the fact that the annual volume of world trade in pharmaceuticals based on only three of the medicinal plants traditionally used by indigenous groups in different parts of the world amounts to $43 billion, none of which comes back to the tribal peoples.

Source: Brazilian Medicinal Plant Foundation

centers to conserve the region's genetic material *in situ*, as a matter of interest to the countries and to all mankind. Conservation of biodiversity should be a priority in the Amazon countries as one of the most conspicuous resources for the region's development. Success will depend on the ability to correct social and economic processes which at present have a pronounced impact on the way space is used—the sustainability of agricultural activities; stabilization of the farm frontier; and erosion of native germ plasm, etc.

Future strategies should be aimed at the following priority goals: (i) the development of national scientific and technical skills and the training of human resources for conservation and management of biotic resources; (ii) the establishment of effective systems of protected ecosystem areas representative of Amazonia; (iii) strengthening of mechanisms to control unplanned and illegal use of wildlife and forestry resources; (iv) promotion of farming and animal husbandry based on native germ plasm; (v) the execution of programs and projects to establish sustainable management of natural forests, wildlife, fisheries, and extraction of products in the region; (vi) establishment of programs to conserve native germ plasm in the countries; (vii) strengthening of the institutional capacity of state agencies for evaluation and planning of the use of natural resources; (viii) the conduct of environmental impact studies for the design of development projects; (ix) support for research on technological alternatives to agrochemicals, including biological control, monitoring of toxic substances and research, plus the use of traditional pesticides; and (x) participation of local inhabitants in the benefits derived from the use of biodiversity.

6.12 Administration of the Shared Basin

Amazonia is an international hydrographic basin and a biome shared by eight countries. Each of them is responsible for its own area but is also responsible for any of its actions that affect the others, either directly or indirectly. The countries must assume an increasing share of this responsibility and act accordingly. One way to do so, obviously, is by strengthening the Amazon Cooperation Treaty, enabling it to meet the needs of international coordination more effectively. In the near future it may also be necessary to consider the possibility of a permanent secretariat for the Treaty, which would greatly facilitate the decisions-making of its members. The international and regional organizations should be ready to assist in that transition.

It is important to note that certain regional initiatives have made noteworthy progress toward horizontal regional cooperation while maintaining their independent status. That is unquestionably the case of the Association of Amazon Universities, which has set up its own information system along with other mechanisms for Amazon integration and cooperation in coordination with the Treaty.

6.13 Amazonia, Purveyor of Environmental Services

As noted in Section 5.5, Amazonia produces services and certain goods whose benefits do not have a determined market value and whose price is difficult to assess, despite the essential functions they perform. That is due mainly to the lack of decisive efforts by the Amazon countries and the industrial countries to develop models to permit such appraisals and establish effective levels of compensation. The goods and services were considered to be cost-free and subject to discounts because the Amazon countries were not the ones to institute the exploitation thereof.

As mankind comes to understand the need to preserve those services and the Amazon countries become aware of the potential these natural resources hold for their economic development, a determined effort at appraisal and compensation is perceived to be essential.

The economic value of a species arises specifically from three possible uses, to wit: as objects for direct consumption or inputs for the production of other goods; as grafts of genetic material to fertilize and thus enhance the profitability of genetic varieties of the same or similar species; and for possible use of the genetic codes to synthesize substances which reproduce the desirable properties identified in the species. Although the estimates are not precise, calculations indicate that roughly 1,000 species of Amazonian plants have economic potential and at least 300 species of trees now have forestry potential.

But perhaps the greatest estimated value of Amazonian biodiversity is as a source of genetic models for technological innovations in chemistry, pharmacology, medicine and agriculture. Biotechnological development increases the possibility that a significant number of species can be used for new drugs and pesticides, chemical products, medicines and food. In the United States, as previously indicated, 25 percent of the prescriptions doctors write are for medicines derived from tropical plants, and the market for those drugs amounts to approximately $8 billion (1980).

Control of deforestation is the most effective short-term solution to preservation of Amazonian biodiversity. Despite the huge benefits this would bestow on all mankind, however, the share of benefits that would accrue to the Amazon countries and the economic agents at work in the region is very small. Nor are there any economic incentives for those countries to act in favor of preserving biodiversity. It is vital that incentives be created to preserve biodiversity. A minimal initiative would consist of technological strengthening of the region's countries so that they too can benefit from the Amazonian genetic heritage.

As noted earlier, preservation of the Amazon rain forest also helps keep the planet's climate stable. Market transactions featuring such global environmental services do not exist at present, and it is difficult to assign an economic value to the benefits they bring.

While most of the studies focus on the impact of deforestation on global warming, deforestation could also have the opposite effect (Molin, 1988), since tropical forests serve as a source of heat in atmospheric circulation. Accordingly, it could in the long term even lead to the extension of the polar cap to lower latitudes.

Amazonia's contribution to global warming is due to the greenhouse effect because deforestation increases the concentration of CO_2 in the atmosphere.

TABLE 9: VARIATIONS CAUSED BY A 50 PERCENT REDUCTION IN GLOBAL EMISSIONS UNDER VARIOUS ECONOMIC POLICY ALTERNATIVES (1990–2030)*

	Effect on Production	Effect on Consumption	Per Capita Effect on Production	Per Capita Emissions
EEC	-4.0	1.4	-3.8	-6.4
North America	-4.3	-1.2	-9.8	-18.6
Japan	-3.7	3.0	-0.9	-2.5
Oil Exporters	4.5	-16.7	-13.0	-15.1
LDCs	-7.1	-4.5	1.8	-1.2
World	-4.4	-2.1	-4.2	-8.5

Source: Whiley and Wigle (1990)
*Present value in real terms as a percentage of GDP

Deforested areas also have a lower photosynthesis level, hence diminished ability to store CO_2.

At present, the level of CO_2 emission into the atmosphere is 7.2 billion tons a year. Approximately 140 tons are produced by each hectare deforested and burned in Amazonia (Nordhaus, 1990 and Myers, 1988). Based on the estimate that 0.5 percent of the Amazon forest is cut down annually (Reis and Margulis, 1988), Amazonia's contribution to global emissions would be on the order of 5 percent.

A number of estimates based on global economic models may help in determining economic policies for meeting the challenge of global warming. Despite their limitations, the results of those models indicate that policies for controlling the present level of emissions could cost between 0.1 and 0.3 percent of the world's annual growth (Hoeller et al., Nordhaus, 1990). Table 9 presents a more detailed picture of these projections (1990).

In terms of costs per ton of CO_2 released into the atmosphere, control of deforestation in the Amazon is one of the cheapest ways to reduce emissions. As noted above, the estimated cost to control deforestation is $4 per ton, as compared with $10 per ton for reducing up to 10 percent of the emissions from the United States energy sector and $130 per ton for a cutback of about 50 percent in that same sector's emissions.

Conservation of Amazonia is a low-cost alternative for the control of CO_2 emissions. Its implementation requires that the Amazon countries be compensated for the cost of preserving these tropical forests. In determining the value of such compensation, given the cost of preservation to the Amazon countries and the amount the market would have to pay to obtain the same results in terms of reduced CO_2 emissions, there is ample room for negotiation. The other services provided by Amazonia—such as its crucial role in the water cycle—are even more difficult to evaluate and appraise.

All these factors illustrate the imperative need for the international community to compensate the Amazon countries in terms of the market value of those services, and for the opportunity cost of supplying them to be taken into account as well.

6.14 Appraising the Value of Amazonia's Natural Resources

The Amazon basin is one of the last frontiers for the world's natural resources. Given the low per capita income of the countries there, and particularly that of the populations whose livelihood depends on the region, the importance of its natural resources to the economic development of these countries can hardly be exaggerated.

Economic appraisal of the Amazon basin's natural resources is difficult. To begin with, the lack of accurate knowledge about the region means that figures and inventories of the existing stocks of natural resources are apt to be vague. For the quantities that are known, no estimates of the profitability or the private costs of exploiting the resources are available. It is thus very hard to evaluate the direct economic value of the natural resources that are marketed privately.

It is nevertheless obvious that even if the global environmental costs cannot be determined, from a strictly national and regional standpoint exploitation of Amazonia's natural resources entails social costs which cannot be ignored when the future development of the region is taken into account. The soil erosion caused by agriculture and mining, the implications thereof in terms of the ecosystem's recovery capacity, plus the environmental degradation triggered by mining are side effects which in the long term will make it impossible to continue other economic ventures. Hence society will pay a heavy price for the products and profits obtained from the exploitation of natural resources, which should be factored into estimates of their true value.

Having posited some of the complex factors in the appraisal of the Amazon's resources, we must nevertheless emphasize that if these ecosystems are to be developed in sustainable fashion, the use of appropriate technologies and an estimate of the worth of the goods and services they produce are essential. As stated earlier, some of the goods can be appraised at market prices; but there are no formally established markets for others, such as biodiversity and the role it assumes in the water cycle and as a reservoir of gases which trigger the greenhouse effect. Given these deficiencies, this section will present a brief description of the goods and services produced by the Amazon region and their relative importance. Due to the scarcity of comparable information for the entire region, our discussion is based mainly on data concerning the Brazilian Amazon, which represents approximately 60 percent of the Amazon tropical forest.

As explained above, Amazonian soils are low in fertility: only 7 percent are firm and fertile. However, the alluvial soils that account for 12 percent of the total are at times extremely fertile (Salati et al., 1990; Schubart, 1989). To assess Amazonia's value as an agricultural frontier for the countries in the region and using the situation of Brazil as an example, if a mere 7 to 8 percent of Amazonian soils are considered suitable for agricultural activities in absolute terms, they represent an area of 300,000 to 400,000 square kilometers, which was equal to between 60 and 80 percent of the arable land in Brazil as of 1989 (Schubart, 1989).

The importance of Amazonia as a mineral resource frontier can hardly be exaggerated. The reserves of the principal minerals discovered and measured in the Brazilian Amazon are worth approximately $1.6 trillion. The relative importance of mineral reserves in the other countries is even greater, especially in those such as the Amazonian portions of Ecuador and Colombia, where vast oil reserves are found . The hydrocarbon potential in this region is considerable. In the case of Ecuador, crude oil and its byproducts accounted for 51.89 percent of the country's 1990 exports (*Información Estadística Quincenal,* Banco Central).

The Amazon basin's hydro energy resources are also considerable. In Brazil alone, the hydro potential is estimated at some 100,000 MW (megawatts), which is equal to 45 percent of the country's total (Camargo and Reis, 1991).

The economic value of timber resources can be appraised on the basis of the lumber marketed, which in Brazil alone is between 48,000 and 78,000 cubic meters. Its market value at 1984 prices would be roughly $1.7 trillion (Repetto, 1988).

The value of the genetic heritage contained in the Amazon ecosystem was cited earlier. It should be emphasized that this is the best example of a public good furnished by the tropical forests, the value of which is probably incalculable.

As noted in Section 6.13, in terms of the percentage released into the atmosphere per ton of CO_2, at $4 per metric ton control of deforestation in Amazonia constitutes one of the least-cost alternatives, as against $130 per metric ton to reduce greenhouse gas emissions in the United States by 50 percent. Conservation of the Amazon is thus a low-cost option for control of CO_2 emissions. Implementation of that alternative requires that the Amazon countries be compensated. The value of such compensation lies somewhere between the costs of conservation to the Amazon countries and what the world would have to pay to obtain the same cutback in terms of CO_2 emissions.

Placing a value on the other services furnished by Amazonia, such as its essential role in the water cycle, is extremely difficult, and it is even harder to appraise the value associated with tropical forests. Attempts at estimating that figure are based on the amounts the world's inhabitants are willing to pay for preservation of these unique assets which constitute a genetic, biodiversity and cultural heritage. A number of examples of existence value can be found in the economic literature on certain animals and other components of nature (Pearce, 1990).

The considerable resources existing in Amazonia suggest that the Amazon countries should be reimbursed at market prices for the global services rendered by Amazonia. Because of the high opportunity cost of not using natural resources—particulary mining and energy resources—it is essential to develop exploitation strategies capable of generating sustainable development of the region, with minimal ecological impact. Such strategies will require effective ecological and economic organization of the area, taking account of, among other factors, maintenance of climatic conditions; maintenance of fresh water sources; protection of soils against erosion; flood control; safeguarding of biodiversity resources; prudent utilization of timber and other forest resources; and preservation of the ecosystems and cultural heritage of the inhabitants of Amazonia.

The search for development options encounters methodological problems, one of which is how to determine the value of natural resources in the future. A knowledge of consumer preferences and available production technologies is necessary for this purpose. That poses two basic questions: the comparison of intergenerational preferences, and uncertainty as to the demand and production conditions that will obtain in the future. Efficient resource allocation at the microeconomic level will not suffice to ensure sustainable development. Attention at this level is focused on the pricing system and ways to internalize the cost of external factors generated by using the environment in such a way that prices reflect the social opportunity cost of economic activities. Another question is the physical scale, or size of the human presence, in the ecosystem, which can be calculated based on the ratio of population to per capita use of its resources (Daly, 1990).

The question of the optimal economic scale for any given ecosystem is different from the question of optimal resource allocation within that economy. Market forces determine optimal allocation, providing the requisite information and incentives. What the market cannot determine is scale (sustainability) and optimal distribution (social justice). As the economy grows, so does its scale, and the outside limit is set by the regeneration or absorptive capacity of the ecosystem to which it belongs. The problem is that maximum capacity and optimal capacity are not synonymous.

Although the concept of optimal scale is not well defined at present, it should be sustainable. Discussion thus centers on the way to limit economic growth to a scale that stays within the bounds of the ecosystem's sustainability. Four factors must be given close consideration in this respect: (i) limiting the human scale to a level that, if not optimal, can at least be sustained by the ecosystem; (ii) technological progress toward sustainable development must be conducive to increased efficiency in the use of natural resources; (iii) exploitation of renewable resources should be based on the principle of sustainable maximization of earnings and should in general not be pursued to the point of extinction, since their importance will increase as nonrenewable resources become depleted; and (iv) nonrenewable resources should be exploited at the same rate at which the renewable resources replacing them are created (Daly, 1990).

The concept of sustainable development makes it clear that optimal allocation and optimal scale are two completely different problems. The main purpose of sustainable development is to design institutions that are capable of keeping the economy within the ecosystem's sustainability limits. Consequently, there are actually three objectives that conflict with any strategy of sustainable development: allocation (efficiency); distribution (social justice); and scale (sustainability).

Like all tropical forests remaining on the planet, Amazonia means different things to different people. As a result, the costs and benefits associated with its resources are not necessarily defrayed and/or received by the same persons. Medicinal plants, for example, wood that can be used for fuel, and the wild animals of the forest provide direct benefits for the inhabitants. Fine wood, on the other hand, is more attractive for sale in markets that are generally located at a distance, and most of the benefits from such commerce accrue to the exploiting companies rather than to inhabitants of the region. Similarly, the forest's capacity to store gases which produce the greenhouse effect plays a more important role at the global level, but means little or nothing to the people who live there.

The question, then, is whose interests—or which individuals or groups—should be considered in decisions regarding the use of Amazonia, and how much weight should be given to the viewpoint of each. But the region also renders global services in connection with the biodiversity existing there, its ability to store gases generating the greenhouse effect, etc. Since there are no markets in which the costs and social benefits of exploitation can be established for these goods, the problem becomes even more complicated.

Most of the variation in the values indicated above stems from this dual function. Amazonia's conservation is of interest to all mankind, especially to the Amazon countries. The goods and services produced by Amazonia belong to its inhabitants and to its countries. The region produces numerous goods and services the benefits of which cannot possibly be assigned to private producers or consumers, nor do they have a given market value. While they play a vital role in the economy of the Amazon basin, the countries of the region, and mankind in general, the public nature of those goods or services is such that a concrete appraisal of their economic worth is impossible. Even an indirect assessment is extremely difficult. The best we can manage is a global approximation of the economic value of the benefits produced by those goods (Camargo and Reis, 1991).

6.15 Financing Sustainable Development in Amazonia

The launching of sustainable development will require additional financial resources which, in turn, implies higher costs. The Amazon countries should of course not wait for external funding to start applying the criteria of sustainable development, based, for example, on the ecological structure of the territory and timely environmental impact assessments. In other words, any outlays that are made by the countries, however small, should be consistent with the new criteria.

At the same time, the Amazon countries must see that the benefits derived from exploitation of local resources—particularly those produced from the activities having greatest environmental impact, such as agriculture , ranching, or mining and hydrocarbons—are channeled to Amazonia itself. There have been precedents of this situation in many countries, among them Peru and at present in Bolivia, where a petroleum levy was established, the proceeds from which are to be used exclusively in the Amazon region that produced the oil. This money was the source of the most extensive investments made there. But there are other ways of attaining this objective: one of them is the granting of greater economic autonomy to the regions, thus enabling them to levy local or regional taxes.

Given the economic crisis besetting the countries of the region, however, it is utopian to think that they can jump-start their economies while financing both sustainable development of the Amazon and performing the numerous urgent tasks needed to protect the ecosystems and biodiversity. In this context, the active search for solutions to the external debt burden of the Amazon countries must continue. Up to now, the innovative solutions proposed—such as debt swaps—are mere palliatives. The delay in resolving this situation only serves to increase the pressure on Amazonian resources.

The preceding chapters of this report attest eloquently to the need for external financing of sustainable development, the most traditional aspects of which (such as agriculture, ranching, mining and energy) will continue to be serviced in the usual way, i.e. , through financing from multilateral (World Bank and IDB) or bilateral banks and the national and international private sector. It is essential that the governments of the countries in the region adhere to the parameters of sustainable development when they execute or authorize those investments, especially those with a significant impact on the Amazonian region.

Insofar as action more directly aimed at protection of the ecosystems, conservation and sustainable use of biodiversity, and other long-term activities limiting deforestation of both world and national interest are concerned, the requirements must be given priority attention through additional global resources on concessional terms or in the form of grants. The United Nations and the inter-American system should play a more important role as intermediaries to ensure that such financing is mobilized. The considerable magnitude of those resources should reflect the global services generated by Amazonia, mainly for the benefit of the industrial countries, plus the alternative opportunity costs to the Amazon countries. Very conservative figures indicate that some $10 billion a year will be required to that end. It will thus be necessary to develop new mechanisms, such as compensation based on market value for the services rendered by Amazonia; taxes reflecting the emission of gases that contribute to the greenhouse effect; and fair payment for the use of the goods and services of biodiversity (possibly in the form of royalties). One way or another, mankind must understand that Amazonia has to be provided with new resources, on a scale never seen before, if this undertaking is to succeed.

It is worth noting, for example, the pilot initiative of the Group of Seven in support of the Brazilian Amazon, as well as the Global Environmental Facility, jointly administered by the World Bank, the United Nations Environment Programme and the United Nations Development Programme. These initiatives are valuable in that they represent a first step in the right direction and are based on recognition of the additional costs that conservation of the environment represents for the countries. These and any other initiatives that may be proposed should, however, be expanded to handle the wide range of problems described here. The proposal to establish an international fund to maintain the atmospheric balance through the contribution of $1 for every barrel of petroleum consumed deserves special mention. Such a fund would certainly contribute to development of the Amazon while preserving the global environment.

Prominent among the projects or areas that warrant highly concessional funds or grants are the following: the establishment and efficient management of national parks and protected areas; pockets of critical poverty which generate migratory pressure on Amazonia; demonstrations of the feasibility of sustainable management of forests and other natural resources; initial investments to explore new markets; the transfer of appropriate technology; social investment in Amazonia's rural districts; research and teaching infrastructure; rehabilitation of degraded zones and the like.

VII

A NEW AMAZONIAN ETHIC

7.1 An Increasingly Small and Interdependent World

Ever since mankind was able to view the planet from a space capsule, no one can fail to realize that no geographic region—not even the vast Amazon—is big enough to escape the need to maintain ecosystems intact. In fact, we didn't need to wait until we could see Amazonia from outer space to understand that. As noted in the preceding chapters, the Amazon is increasingly affected by events and decisions outside the region, both in the developed countries and in the countries of Latin America—particularly in the Amazon countries themselves. Similarly, we now know that the repercussions of that impact will sooner or later be felt in the regions or countries that were its source.

Notwithstanding the primary responsibility that belongs to the Amazon countries, development and conservation of Amazonia should be the shared duty of all peoples of the world who may have an impact on it or who depend on the environmental benefits the area provides.

7.2 Breaking the Double Standard

The solution to present problems as well as those that stem from the continuation of activities that have a severe social, economic and environmental impact depend largely on a new ethical approach and the redressing of injustices. At present a double standard prevails internationally. Little ethical consideration is being given to the difference between what we are told is needed in the region and what the developed countries are doing. On the one hand, the countries of the basin are asked, and even pressured financially, to protect the tropical forests and biodiversity because of the global services they perform; on the other, development models and technologies are promoted that are not compatible with conservation, with no regard for the rightful needs and aspirations of the countries and inhabitants of the region. Conservation of the natural resources of the Amazon is urged at the same time that those resources are being used in ways that are inconsistent with their conservation.

A new ethical approach should acknowledge the errors committed in the past and seek a new basis for relations within and between countries, especially between developed countries and those of the basin. The principles that govern the new approach should be aimed mainly at consideration of the needs of the region's inhabitants, compensation for the environmental services received, equitable distribution of land, respect for human rights and ecological rights, repatriation of information, reciprocity with respect to technology in exchange for the region's genetic legacy, and more information from the developed countries.

The key factors to be considered in assessing the needs and well-being of the region's inhabitants are: (i) the rights of the Indian and other peoples of the forest to the resources on which their economy is based; to this end, it is essential to establish territorial options for management of extractive resources; (ii) recognition, endorsement and promotion of their production systems with very low environmental impact and the offering of incentives, as has been done in working with systems with high environmental impact; (iii) recognition of their knowledge and granting of the necessary credit; (iv) the establishment of equitable economic relations, to provide them with financial benefits for their scientific contribution; and (v) assignment of high priority to establish permanent mechanisms that ensure that a substantial percentage of the economic benefits are felt at the local level, in the form of more equitable commercial relations or a decentralized fiscal return.

Participation of the inhabitants of Amazonia in decisions concerning the region is another ethical matter that should be taken into account in the future. In a participatory concept of democracy, the Amazonian population has a great deal to contribute to a sustainable development approach. This would avoid a repetition of the errors of the past, when all of the decisions regarding the region's development were made elsewhere and without the participation of the people affected. The Amazonian populations—especially the Indians and the extractivists—are organized in regional and national federations, which facilitates their participation. The governments of the basin must make a sincere effort to consult the local residents and take advantage of their experience. Researchers in the fields of environmental and social sciences, technologies, and economics should also play a more active part in decision-making. This naturally implies a change in the attitude of politicians and at central decision-making levels where projects are routinely imposed without consultation.

Top priority should be assigned to control of exaggerated market demand for certain products, legal or illegal, especially outside the region. On the one hand, the harvesting of ecosystem products in their natural state is one way to heighten interest in their conservation and preventing their destruction. On the other, however, exaggerated demand for certain products can cause serious damage to species and ecosystems.

Plundering genetic heritage or biodiversity, and using the scientific knowledge of indigenous peoples without compensation or acknowledgment of property or intellectual rights, are other manifestations of an unfair ethical relationship, especially when the products have a high commercial value. Two very telling instances in the past were the illegal exports of rubber tree seeds from Brazil and quinine bark from Peru. Today the most flagrant example is the knowledge obtained from native herb doctors and shamans. Its efficacy is verified, but no credit is ever given to the people who first discovered those properties, not even among the acknowledgments listed in scientific publications.

In a new ethical relationship it should be possible to establish international standards for timely control of excessive exploitation induced by demand. This might be achieved, for example, by growing the species in the places of origin when demand exceeds the volume that the ecosystems can support. The germ plasm must remain at the places of origin so that the benefits can accrue to the local populations.

The rights of living species to subsist and develop should also be recognized. It is a basic ethical principle that human beings cannot lay claim to the divine right to eliminate species which they can never again create. The establishment of nature preserves of various types must therefore be a major concern. Part of the ecological right concerns not only biodiversity, but the social diversity of peoples whose existence is closely identified with the ecosystems and whose quality of life depends on a natural environment very different from those of the highly industrialized societies.

It is essential to avoid double standards and selfish attitudes on the part of the developed countries in regard to conservation of the region and the responsibility they bear for promoting injurious technologies contributing to the planet's environmental problems. Transnational companies take advantage of the developed countries' duplicity and the lack of adequate legal mechanisms and controls in the countries of the basin to continue their depredation of natural resources, pollution of the environment, and assault on the indigenous peoples. It is also unethical to respect the public demand for a clean environment in their own countries while ignoring the rightful protests of the Amazonian populations who want not only more justice but protection against the destruction of their resources, as is the case in the claims of the tribal peoples. Provision should be made in a possible international code of conduct to prevent countries and transnational companies from using technologies that are damaging to the ecosystems.

This new approach also implies an increase in the ethical parameters of scientific relations, especially with regard to the repatriation of specimens and the scientific information generated by researchers and institutions using the region's resources, even if they are not used for financial gain. A very high percentage of the findings of scientific research is produced outside the countries of the basin, despite existing laws. Amazonian researchers should strive to repatriate this information to the countries it comes from. The information is needed as a basis for decisions that may well determine the future of the region.

The developed countries and the organizations that exert international pressures should also be concerned with securing more objective information about all aspects of Amazonia. This could help avoid activities that cause more damage than benefits or might impoverish the local populations even more. In particular, it should be understood that preservation of Amazonia will require that action be taken outside this area, in the regions of greatest poverty in Latin America. The primary cause of the region's stalled economic growth is the external debt burden. The possibility of saving the Amazon tropical forest, stemming the tide of colonization, and establishing a new framework for Amazonian development will depend on the proper understanding of Amazonia in the Latin American context.

The governments in the basin must make a major effort to institute sustainable development of Amazonia. In the first place, the economic and social problems of the peripheral areas must be solved in situ rather than transferred to Amazonia. The large-scale settlement processes have shown us that those problems not only persist but cause additional problems as well.

Secondly, emphasis should be placed on areas of the Amazon itself where there has already been colonization and intervention, using appropriate technologies to boost production and revive deteriorated resources. Too many sites have been readied and then abandoned. Ethical responsibility forbids the perpetuation of these models of destruction and abandonment.

Thirdly, the grave injustices in the peripheral areas must be addressed. The unsolved social and economic problems there have triggered social pressures. The politicians have preferred to ease these pressures by opening up the Amazon region to mass colonization rather than giving due consideration to the possibilities for sustainable development. For the last forty years, large-scale settlements have been used as an easy way to solve the problems of those outlying districts. More recently, in the face of the discouraging results of settlement attempts and new social problems (drug trafficking, lack of security, aggression against tribal peoples, poverty, and the like), the politicians have become so discouraged that they no longer seem to know which way to turn. A few of the countries have begun to address the need to understand the problems confronting the depressed peripheral areas instead of pursuing the simplistic approach of colonizing the region. That reaction, however, might be due more to the national and international economic crisis than to an understanding of the true dimensions of the problem.

7.3 A Noble Cause for Unifying Humanity

There is need for a more open and sincere dialogue about the Amazon. The Amazon is a noble cause around which humanity should unite. A new strategy for Amazonian development is linked with a series of events and processes already unfolding in the region and in the world, creating the need for new scientific and technological techniques. These in turn can be instrumental in redefining the division of labor and restructuring productive endeavor at the world level.

The future of the Amazon depends upon our skill in establishing a framework of common interest that will transcend rhetoric and become a tangible reality. It will require a commitment to mutual respect and cooperation among peoples of all the Amazonian countries and of the world; a new pact of lasting solidarity for all peoples united around the Amazonian cause—a cause that represents today, as it has for many centuries, the adventure of man on earth.

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